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ABSTRACT

Materials in this curriculum guide are designed to provide regular and special education instructors at the elementary school level as well as the industrial arts specialist-consultants with industrial arts activities to be used to enrich the elementary school curriculum. Topics in the guide include the following: a definition and a philosophy for the inclusion of industrial arts activities at the elementary school level; general goals for both the elementary school and industrial arts in the elementary school; objectives to stress with special needs students; ways of integrating industrial arts into the elementary school curriculum; and the implementation of career education through elementary school industrial arts activities. A major portion of the guide consists of projects and activities by grade level (K-6). Each project includes behavioral objectives, developmental tasks, integration of the project with other subject areas, how the project facilitates career education, a bill of materials, tools needed, and working drawings. Information sheets for use in an inservice workshop for elementary school teachers, layouts of sample facilities for conducting elementary school industrial arts activities, a suggested tool list, and an annotated bibliography are also included. (Author/JH)

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A CURRICULUM GUIDE FOR INDUSTRIAL ARTS IN THE ELEMENTARY SCHOOL

DEVELOPED BY:

I.A. 459 - INDUSTRIAL ARTS IN THE ELEMENTARY SCHOOL
FALL, 1977 CLASS

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U S DEPARTMENT OF HEALTH, EDUCATION & WELFARE
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PREFACE

This curriculum guide, developed by the Fall, 1977 class of IA 459-Industrial Arts in the Elementary School is intended to provide both regular and special education instructors at the elementary school level with some understanding of how industrial arts activities can be utilized to enrich the elementary school curriculum. This guide is also designed to be used by the industrial arts specialist-consultant employed to initiate industrial arts activities at the elementary school level.

The Fall, 1977 IA 459 class at Central Connecticut State College hopes that users of this curriculum guide find it helpful in meeting their needs, and inspirational in the development of industrial arts programs and activities at the elementary school level.

DEFINITION OF ELEMENTARY SCHOOL INDUSTRIAL ARTS

Elementary School Industrial Arts may be defined as the process of using tools, materials, activities, creativity, and manipulative skills to reinforce the learning process, explore careers, and to solidify the cognitive domain of the child in his/her technological world.

PHILOSOPHICAL STATEMENT

The increasing complexity of our economy and the increasing amount of automation encountered in almost every phase of our daily living and the opportunity that it affords for integrating abstract subject matter into more meaningful experiences for the child, make it essential that Industrial Arts experiences be regarded as basic and fundamental for all youth.

Industrial Arts should not be the key subject being taught, but rather, it should be used to reinforce the major subject areas.

In teaching Industrial Arts at the elementary school level, the main emphasis should be put on the following areas: Awareness of surroundings (Social and environmental), and development of manipulative skills and coordination, with less emphasis put on teaching of trade related skills.

GENERAL GOALS OF THE ELEMENTARY SCHOOL

"Learning begins with contact with the real world, and establishing that contact is a fundamental task of the elementary school.

The school must insure, at every level, that sufficient, appropriate, cultural contact takes place to permit meaningful learning of the subject matter of the curriculum.

One of the most necessary, pertinent, and appropriate areas for study in the elementary school involves man's industries."* Therefore, an elementary school must comprise specific goals which the educational system should stress on behalf of the students' curriculum.

1. Provide a stimulating atmosphere where children want to come and participate.
2. Foster the development of a positive self-concept for each child.
3. Develop positive peer relationship and interaction.
4. Provide an atmosphere where the child may feel free to express his thoughts and opinions without fear of criticism.
5. Build the child's sense of responsibility.
6. Provide varying degrees of structure and freedom according to the child's independence level.
7. Provide each child with an academic education in reading, writing, and math, and to encourage him to progress to the best of his ability.
8. Encourage the child to develop a respect for personal property, both his and others.
9. Develop a sense of "Esprit de Corps." (We're a family)
10. Develop the child's gross and fine motor skills.
11. Help the child to progress from concrete experiential learning to abstract thinking.

*Gerbracht, C. and Babcock, R. Elementary School Industrial Arts (New York: Bruce Publishing Co., 1969) 280 pp.

GOALS OF INDUSTRIAL ARTS IN THE ELEMENTARY SCHOOL

The goals of Industrial Arts in the elementary school should be designed to develop a close relationship between its programs and those of general education for the elementary student. Industrial Arts should be used to develop the student's personal needs, social needs and physical developments, as well as their economic and vocational education.

1. Industry and related fields - Goals of elementary school industrial arts.

Occupations	are to enlarge the understanding
Processes	industry and industrial processes
Products	in which man changes his natural resources to increase his well being.

2. Working together - To teach cooperation and values of working together.

3. Consumerism - To develop an appreciation of the importance of industrial products and industrialization within modern social and economic life.

4. Concreteness to other areas - To help carry out the lesson taught in the academic subjects using the hands-on concept.

5. Physical development, skills, gross motor, fine motor - To aid in the development of fine muscle tone through the use of various hand tool and shop practices.

6. Safety - To teach safety procedures that will be applicable not only to the shop areas, but ones that are practical in everyday life.

7. Career awareness - Provide understanding of the influence that industrial processes have on the changes in social, political, and economic institutions within our society.

8. Tying academic areas together - Understanding the interrelationships of subject areas.

STUDENTS WITH SPECIAL NEEDS

Children with Learning and/or Emotional Problems and the Mentally Handicapped

Due to federal legislation, primarily PL 94-142, many youngsters with learning problems, social and emotional problems, the mentally retarded, and the physically handicapped are being placed in regular classrooms. Often teachers are ill-prepared to add this burden to an already overcrowded and under-funded situation. Lack of experience, teamed with requests for individual programs for these multi-labeled children have only served to foster an environment of dread and confusion. Industrial Arts activities are especially crucial for these students, who learn best with hands-on activities--learning by doing. Some basic definitions, management suggestions, and objectives to stress with these children will be presented here. Obviously, this is merely a brief introduction into the area of special education, but hopefully a beneficial one.

The E.M.R., or Educable Mentally Retarded child, has an I.Q. range of 50-80. The Slow Learner's I.Q. ranges from 80-95. An L.D., or Learning Disabled, youngster is often of average or above average intelligence, but may have difficulty in one or more academic areas and progress at a rate which is below that of a "normal" student. The E.D., or Emotionally Disturbed, student may be of any level of intelligence, but emotional problems interfere with his learning and often he manifests behavior which is considered socially unacceptable.

The students just described are often labeled and categorized in the elementary school and they possess more similarities than differences. Most cannot function successfully in the regular clasroom environment without some special help or intervention. Other similarities also exist, such as the following:

- Academic lag
- Social immaturity
- Poor self-image
- Attention-getting behaviors
- Short attention span
- Difficulty following directions
- Distractibility
- Hyperactivity

Some Objectives to Stress with Children with Learning and/or Emotional Problems and the Mentally Handicapped are:

1. The student will demonstrate proper and safe handling of shop tools.
2. The student will demonstrate socially-appropriate behavior in the laboratory.
3. The student will complete a project designated by the teacher, following the directions provided.
4. The student will accept constructive criticism in a positive manner.
5. The student will accept responsibilities of classroom jobs, such as clean up, etc. when appropriate.
6. The student will improve his eye-hand coordination through manipulation of various tools, the exception being the visually handicapped student.
7. The student will develop realistic goals toward possible future career choices.
8. The student will develop skills useful in leisure time activities.
9. The student will work ccoperatively with his classmates.

The Gifted

The gifted population is a small, but important one. They are usually identified through teacher recommendation and an I.Q. score of 130+ on a variety of written and verbal tests. Their mental endowments may be concentrated in one particular area, or be reflected in a general superiority in all subject areas. Gifted children are often superior physically and socially as well. They seek out older companions, seem to be able to reason more effectively, and they excel in school. These students, like other students with special needs, often suffer from a regular classroom environment. Unchallenged, they become restless, inattentive, disinterested, and generally turned off to school. Industrial Arts activities can provide the avenue needed to channel their creativity and originality, while fulfilling other needs as well.

Some objectives to stress with the gifted are:

1. The student will demonstrate the safe, proper handling of all shop tools.
2. The student will demonstrate competencies in the areas of organization and leadership by assigning various jobs on an assembly line, and overseeing a production to completion.
3. The student will plan and carry through to completion a self-designed project.
4. The student will accept constructive criticism in a positive manner.
5. The student will research the competencies needed to be employed in three occupations of his choice.

The Blind

The blind or visually impaired student in the elementary school needs to develop a sense of independence. Since his major source of information is through the sense of touch, blind students would most certainly benefit from Industrial Arts projects.

Some objectives to stress with the blind student are:

1. The student will become familiar with the physical layout of the shop area, and the shop tools.
2. The student will properly replace each tool after he has finished with it.
3. The student will complete a project independently, using either verbal directions or tape recorded instructions for assistance.

The Deaf

Children who are deaf or hearing impaired are usually of average intelligence. They are not retared, and should not be treated as such. Communication is the major difficulty concerning this type of child. Many can read lips and use sign language. Objectives to stress with the deaf child can be the same as those stressed with the normal student. However, there are some concerns to be aware of, as listed below.

1. Step-by-Step presentations should be given prior to a project's undertaking, this will clarify all directions given.
2. It is difficult to attract a deaf person's attention in the normal manner. Flick the lights, or have another student touch him.
3. When addressing the group, make sure you are facing the deaf child, so that he may get a clear view of your mouth.
4. If confused, ask the child to repeat himself until understood. Deaf students prefer to take the time to be understood rather than to be ignored.
5. If possible, learn a few signs. This especially encourages the deaf child, and indicates that you are sincerely interested in teaching him.

The Physically Handicapped

The motorically handicapped, or those with obvious physical defects, may be wheelchair bound, or merely present obvious coordination problems. Industrial Arts provides the opportunity for them to strengthen the areas in which they have the greatest impairments. The finished product is not so much the concern as the effort extended, and the social benefit received by the child.

Some objectives to stress with the physically handicapped child are:

1. The student will demonstrate appropriate social behavior when working with a non-handicapped peer on a project. (Student is to assist, not take over project.)
2. The student will complete a self-selected project independently.
3. The student will accept constructive criticism in a positive manner.
4. The student will accept his limitations, and choose projects which reflect his functioning level.

SUGGESTIONS FOR WORKING WITH SPECIAL NEEDS STUDENTS

A number of unwanted situations can be avoided in the classroom by careful planning and a positive, consistent approach. Below are some preventative measures which are often helpful:

1. Keep the rules few and simple. Make sure they are familiar to the student.
2. If possible, demonstrate the proper handling of a tool prior to any activity which requires its use.
3. Stop an inappropriate behavior as soon as possible, and try to provide an appropriate one for the student to model.
4. Structure an activity to the student's needs. If he has a short attention span, provide a few, short activities.
5. Provide a finished product as a model, and if possible, present a step-by-step demonstration of its development. Don't rely on written directions or diagrams to instruct a child.
6. Lastly, be lavish, but honest, with praise. A child who receives praise without effot, soon makes no effort.

INTEGRATING INDUSTRIAL ARTS INTO THE ELEMENTARY SCHOOL

According to Gerbecht, Industrial Arts provides subject matter content that helps the child understand the industrial, technological nature of his world. It also provides first-hand, constructive, purposeful contact with material objects and thereby enhances the total learning process. Industrial Arts is also a means of adding concreteness to other academic areas.

Industrial Arts can be integrated into the elementary school using the scheduled or unscheduled approach. The scheduled system uses specific allotted time periods for I.A. work. The unscheduled sytem has the teacher arrange time for the program when it is needed. Either system works best when the classroom teacher is present. The teacher may work as an assistant to the I.A. specialist, and has full power in determining which I.A. activities are best suited for that course of study. Ideally there should be a connection between classroom work and the Industrial Arts activities performed.

Grades K-1

Industrial Arts can be implemented into the curriculum of grades Kindergarten and One through the study of the Pilgrims. A suggested activity could be the construction of a Pilgrim Horn Book which can touch upon social studies, lettering, math, art, self-help skills, and citizenship.

Topic: Pilgrim History
Activity: Construct the simple sailboat
Social Studies - learning about the way people have learned in the past
Lettering - practice penmanship
Math - measure the length of the board
Art - draw pictures on the board
Self-help Skills - tie the leather lace
Citizenship - write out the Pledge of All

Grades 2-3

Industrial Arts can be implemented into the curriculum of grades Two and Three through the study of transportation. A suggested activity can be the construction of a covered wagon.

Topic: Transportation
Activity: Construction of a covered wagon.
Social Studies - the Westward movement of the pioneers
Language - The use of books to show how the pioneer moved West
Math - Measuring to build the wagon
Science - Where the different materials come from
Fine arts - The esthetic design and decorating of the wagon.

Grades 4 - 5

Industrial Arts can be integrated into the curriculum of grades Four and Five through the study of textiles and clothing. A suggested activity can be the construction of a simple loom rug.

Topic: Textiles and clothing
Activity: Construction of a loom rug.
Social Studies - How was the loom invented, how it progressed and how it is used in other cultures.
Language - Vocabulary related to the loom, writing a booklet on its history and directions on its use.
Math - Measuring to build the loom.
Science - Learning about different fibers, their structure and process of dying.
Fine arts - Sketches of plans, design of loom, pictures of past looms, finish on loom, design of color patterns to be weaved.

Grade 6

Industrial Arts can be implemented into the curriculum of grade Six through the study of a shelter. A suggested activity can be the construction of models of colonial and modern homes.

Topic: Shelter
Activity:- Construction of colonial and modern homes.
Social Studies - Study differences between colonial and modern
Language - Learning new vocabulary
Math - Use of metric and English systems.
Science - Basic principles of machines and their use in building types of materials
Fine arts - Design and decorate homes of past and present.

IMPLEMENTATION OF CAREER EDUCATION

Career education in the elementary school should be used as a tool by the teachers to develop students' insights and interests in the occupational areas of American industry. At this time in a students' educational development, they are starting to become aware of different occupations. Career education should be used to broaden their knowledge as much as possible.

The programs used to introduce career education should come from both the academic and industrial arts areas. They should work together to give the students the best possible insight into present and future occupational needs of industry and the community.

METHODS OF IMPLEMENTING CAREER EDUCATION IN THE ELEMENTARY SCHOOL

1. Discussion of persons' careers in the home, in school, and in the community.
2. Field trips to construction sites would enable students to observe various jobs as they are performed on the spot.
3. Role playing enables the students to take on different careers and describe the nature of the jobs to the class.
4. Guest speakers, with diverse occupations, could be asked to come in and speak to the class. These could include the students' mothers and fathers, husbands and wives of the teachers, or even friends who may be employed in jobs that may be of interest to the class.
5. Films and slides could be shown to the class depicting various occupations which could serve as an introduction for discussion of different careers.
6. Magazines and pamphlets could be distributed to the class as a means of communication. They could serve as the voice for the careers of those persons who could not come to the classroom and explain what their job entails.
7. When students are involved with an industrial arts activity which depicts an event or era in early America, a discussion could be conducted regarding the careers or jobs important then, and why they are or are not still important today.
8. If the students become involved in a mass production project, they could study the occupational requirements and responsibilities of production positions which they are portraying.

APPLICABLE PROJECTS AND

ACTIVITIES BY GRADE LEVEL

ELEMENTARY SCHOOL INDUSTRIAL ARTS PROJECTS AND ACTIVITIES REFERENCE TABLE

Grade Level	PROJECT OR ACTIVITY TITLE	Page Number	CAREER EDUCATION					SUBJECT MATTER RELATIONSHIP						
			Awareness of Occupations	Self Concept	Decision Making	Work Attitudes	Academic Cognitive	Art	Health	Language Arts	Mathematics	Music	Science	Social Studies
K-1	SIMPLE SAILBOAT	13	X	X	X	X	X	X			X		X	X
K-1	THE COMMUNITY	16	X	X	X		X	X		X	X			
2-3	PLANTER	18	X	X	X	X					X		X	X
2-3	PILGRIM HORN BOOK	21												
3-4	IQ GAME	24	X		X	X			X		X			X
3-4	LIGHT BULB QUIZ	29	X		X				X	X	X		X	X
4-5	WOODEN AIRPLANE	33	X	X				X			X		X	
4-5	CANDLE MAKING	37	X	X	X			X		X	X		X	X
5-6	KITE	42	X	X		X	X						X	X
5-6	WALL CANDLE HOLDER	52	X	X	X	X					X		X	
5-6	SILK SCREEN	57	X		X		X			X	X			X

Adapted from the AIC/EE Project, Wichita Public Schools, Wichita, Kansas.

SIMPLE SAILBOAT - SUGGESTED GRADE LEVEL - K-1

I. Objectives

Upon completion of this project, the student will be able to:

1. Use a template to trace a shape.
2. Use a pair of scissors to cut out a traced shape.
3. Use a ruler to measure by inches.
4. Use a miter box with assistance.

II. Developmental Tasks Facilitated By This Project

1. Motor skill development.
2. Establishment of handedness and eyedness.
3. Development of large muscles.

III. Integration of Project With Other Subject Areas

1. Mathematics- counting the inches on a ruler.
2. Art- decorating the boat and sail.
3. History- how man has used the sailboat.(Columbus)
4. Science- using wind to power the boat.

IV. How Project Facilitates Career Education

1. Awareness of occupations related to sailboats. (builders, sailors)
2. Working with peers with good relations.
3. Develop foundation of wholesome attitudes towards work and society. (pride in work)
4. Decision making in decorating the sailboat.

V. Procedure

1. Obtain necessary tools and materials.
2. (TEACHER)
   precut boat section
   locate center of boat
   bore One-quarter inch hole
   make template of sail

(STUDENTS)

3. Using a ruler, measure 4 inches from the end of the dowel. (mast)
4. Using a miter box, saw the mast to 4 inches.
5. Apply glue to the bottom of the mast and push into the hole in the boat.
6. Using a template trace the sail.
7. Using scissors,cut out the sail.
8. Fold the sail in half parallel to the 4 inch edge.

Procedure (continued)

9. Using a paper punch, make two holes in sail approximately 1 inch from opposite edges along the folded line.
10. Flatten sail and decorate using crayons.
11. Assemble sail over mast.
12. Using crayons decorate the finished boat.

VI. Bill of Materials

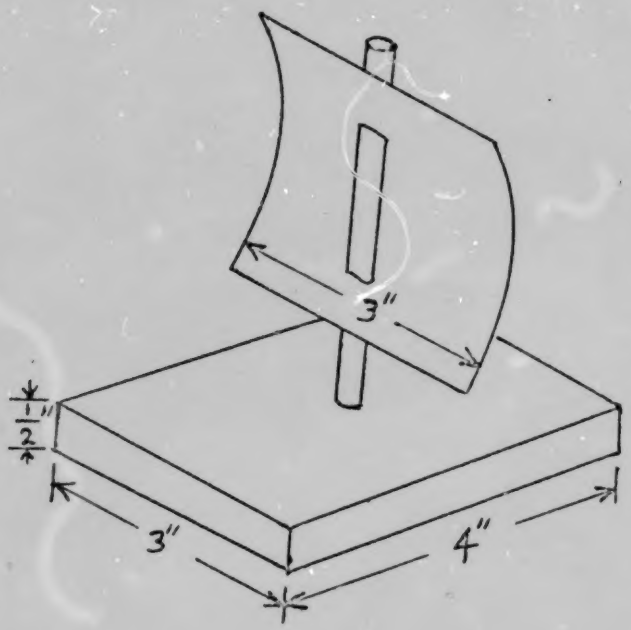
1. Pine block 4 X 3 X 1/4 inches
2. Paper
3. Dowel 1/4 inch in diameter
4. Crayons
5. Glue

VII. Tools Needed

TEACHER
1. Saw
2. Ruler
3. Drill
4. Bit 1/4 inch

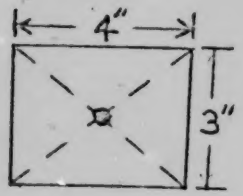
STUDENT
1. Ruler
2. Miter box / saw
3. Scissors
4. Paper punch

SIMPLE SAILBOAT

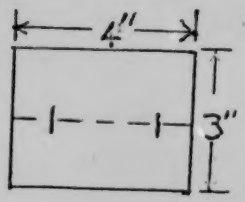


3 PARTS

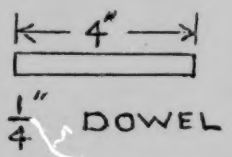
BOAT



SAIL



MAST



THE COMMUNITY - SUGGESTED GRADE LEVEL - K-1

I. Objectives

Upon completion of this project, the student will be able to:

1. Name at least 1 building found in a community.
2. Name at least 1 job done in the community.
3. Trace a 3 dimensional object.
4. Cut out with scissors the rectangular shapes he traced.
5. Cover a box with paper using glue.
6. Name the characteristics that his building posseses.

II. Developmental Tasks Facilitated by this Project

1. Social awareness of self in community
2. Basic awareness of the role of work in the community
3. Eye-hand coordination
4. Social interaction through idea sharing and working on a common project.
5. Encouragement of individual creativity

III. Integration of Project with Other Subject Areas

1. Social Studies - field trips to bank, P.O., store, etc.,
2. Art - drawing and cutting, making clay objects for community
3. Safety - need for road and traffic signs, traffic lights

IV. How Project Facilitates Career Education

1. Children visit community workers and their places of business.
2. Children name various jobs which are essential to the community.
3. Children become aware of the breakdown of various jobs within a business establishment.

V. Procedure

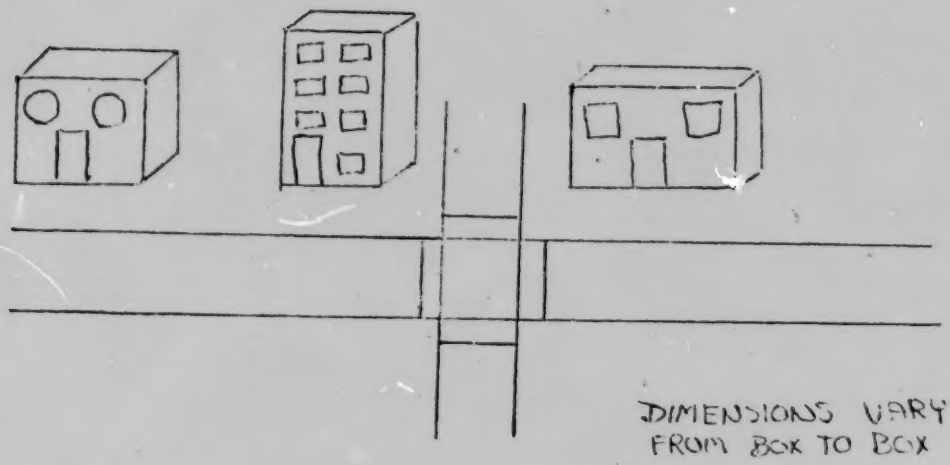
1. Children take field trips to bank, P.O., store, and other community buildings.
2. Discussion in class about different services needed in a community and who does them.
3. Sand Table, of large plywood board is set up to resemble the streets and blocks of a town.
4. Students talk about buildings needed in a community.
5. Set up materials necessary to cover small boxes with paper.
6. Students trace each side of their box on paper.
7. Using scissors, they cut out each rectangle.
8. Using paste, the student matches paper with the correct sides, and glues each piece on.
9. Using a crayon, the student draws windows and doors on each building.
10. Optional roof of a paper folded in 1/2 may be glued to top of house.
11. Students place buildings in the community environment.
12. Any extra individual creativity to enhance the community environment can be encouraged.

VI. Bill of Materials

Small boxes of various sizes
Construction paper, 9x12, various colors
Paste
Optional : clay, tissue paper, popsicle sticks, etc.,

VII. Tools Needed

Scissors
Pencils
Crayons



PLANTER - SUGGESTED GRADE LEVEL - 2 & 3

I. Objectives

Upon completion of this project, the student will be able to:

1. Use a rule to measure even inches.
2. Use a miter box and saw to make accurate cuts.
3. Use a compass to draw curves.
4. Use a coping saw to cut curved lines.
5. Use a hammer and nails to fasten pieces of wood together.
6. Use a file and sand paper to smooth a wooden object in preparation for staining.
7. Use a hand drill and $\frac{1}{4}$" drill bit to drill holes in wood.
8. Apply a stain finish to wood.

II. Developmental Tasks facilitated by this project

1. Fine muscle control.
2. Eye - hand coordination.
3. Develop a basic understanding of linear measurement.

III. Integration of project with other subject areas

1. Mathematics - basic measurement
   Social Studies - lumber industry
   farm history
   agriculture
   Science - agriculture

IV. How project facilitates Career Education

Teach about careers in Forestry, Carpentry and Agriculture.

V. Procedure

1. Obtain necessary tools, materials and jigs.
2. Lay out stock to be cut.
3. Using a miter box cut ends, bottom, front and back pieces.
4. Using a compass draw 1" radius corners in back piece and cut same with a coping saw.
5. Using a hand drill make five $\frac{1}{4}$" drain holes in the bottom piece.
6. Using a jig to align the bottom and one end, nail the end to the bottom.
7. Turn the bottom around and repeat this process using the other end.

8. Nail front piece to bottom and ends.
9. Nail back piece to bottom and ends.
10. Using a file and sand paper, smooth all surfaces in preparation for staining.
11. Apply a coat of weather resistant stain.

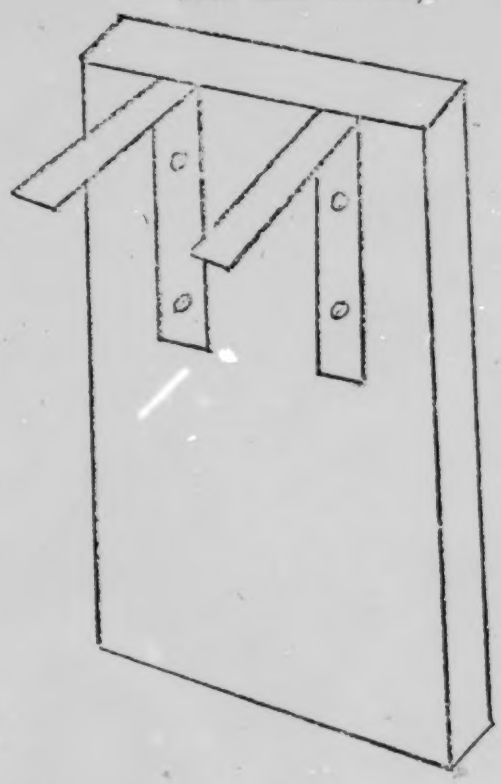
VI. Bill of Materials

½" x 3 #2 pine 12"
½" x 5 #2 pine 12"
¾" x 3" #2 pine 18"
8d galvanized finish nails
stain

VII. Tools Needed

Miter box and saw
Ruler
Compass
Square
Hammer
Sand Paper
File
Jig
Pencil
Paint Brush
Rags
Hand Drill
½" Drill Bit
Coping Saw

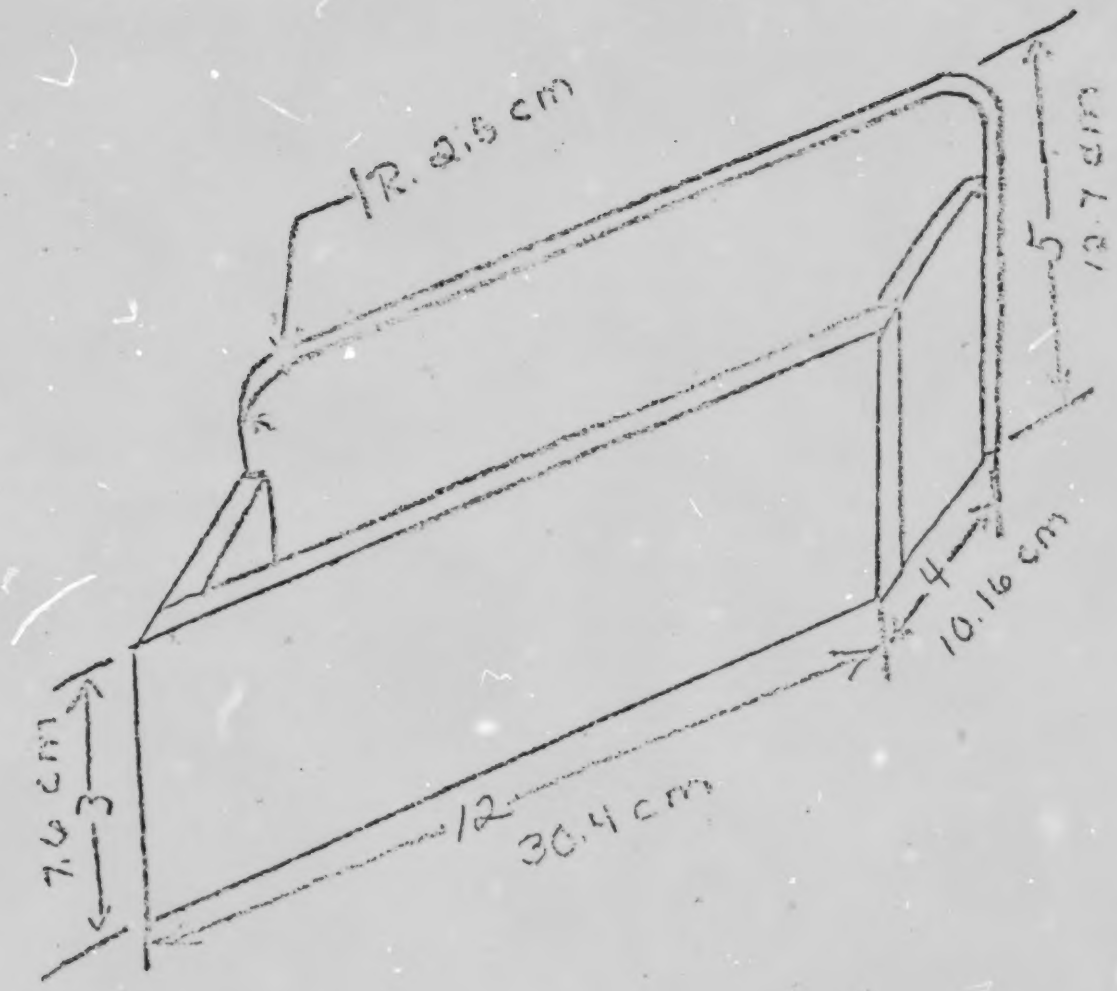
3" Corner Brackets (attach with wood screws)



3/4" X 4" X 8"
#2 Pine

PART DIMENSIONS

Ends	3" (7.6 cm) x 3" (7.6 cm) x 3/4" (1.9 cm)	2 needed
Front	12" (30.4 cm) x 3" (7.6 cm) x ½" (1.25 cm)	
Back	12" (30.4 cm) x 5" (12.7 cm) x ½" (1.25 cm)	
Bottom	10½" (26.7 cm) x 3" (7.6 cm) x 3/4" (1.9 cm)	



PLANTER

PILGRIM PRIMER HORN BOOK - GRADE 2

I. Objectives

Upon completion of this project, the student will be able to:

1. Use templates to trace shapes.
2. Cut out shapes with a coping saw.
3. Sand and file wood.
4. Apply stain to wood project.
5. Glue paper to a board.
6. Apply a coat of mod-podge over a piece of paper and board.

II. Developmental Tasks Facilitated By This Project

1. Large and fine muscle control.
2. Learn to work with others.
3. Interest with one's history. Learning the way this used to be done.
4. Learn about basic woodworking hand tools.
5. Eye-hand coordination.

III. Integration of Project With Other Subject Areas

1. U.S. History-Learning about the ways children learned during the 1600's.
2. Penmanship- Lettering in the alphabet and the Pledge will serve as a lesson in penmanship.
3. Mathematics-measuring the length of the board.
4. Art-create pictures to draw in the corners of the paper.
5. Self-Help Skills-tie leather lace on the handle.

IV. How Project Facilitates Career Education

1. Teacher could review any of the woodworking trades.
2. With the emphasis on teaching as a career the role of the teacher can be discussed.

V. Procedure

1. Make template (teacher).
2. Measure, draw line with square and cut board to length with crosscut saw.
3. Trace pattern unto board.
4. Cut handle and corners with coping saw.
5. Drill hole in handle.
6. Sand and file edges.

V. Procedure (cont.)

7. Stain wood.
8. Letter in paper.
9. Fasten paper to board with paste.
10. Apply modge-podge.
11. Edge paper with ribbon held down with thumb tacks.
12. Tie on leather lace.

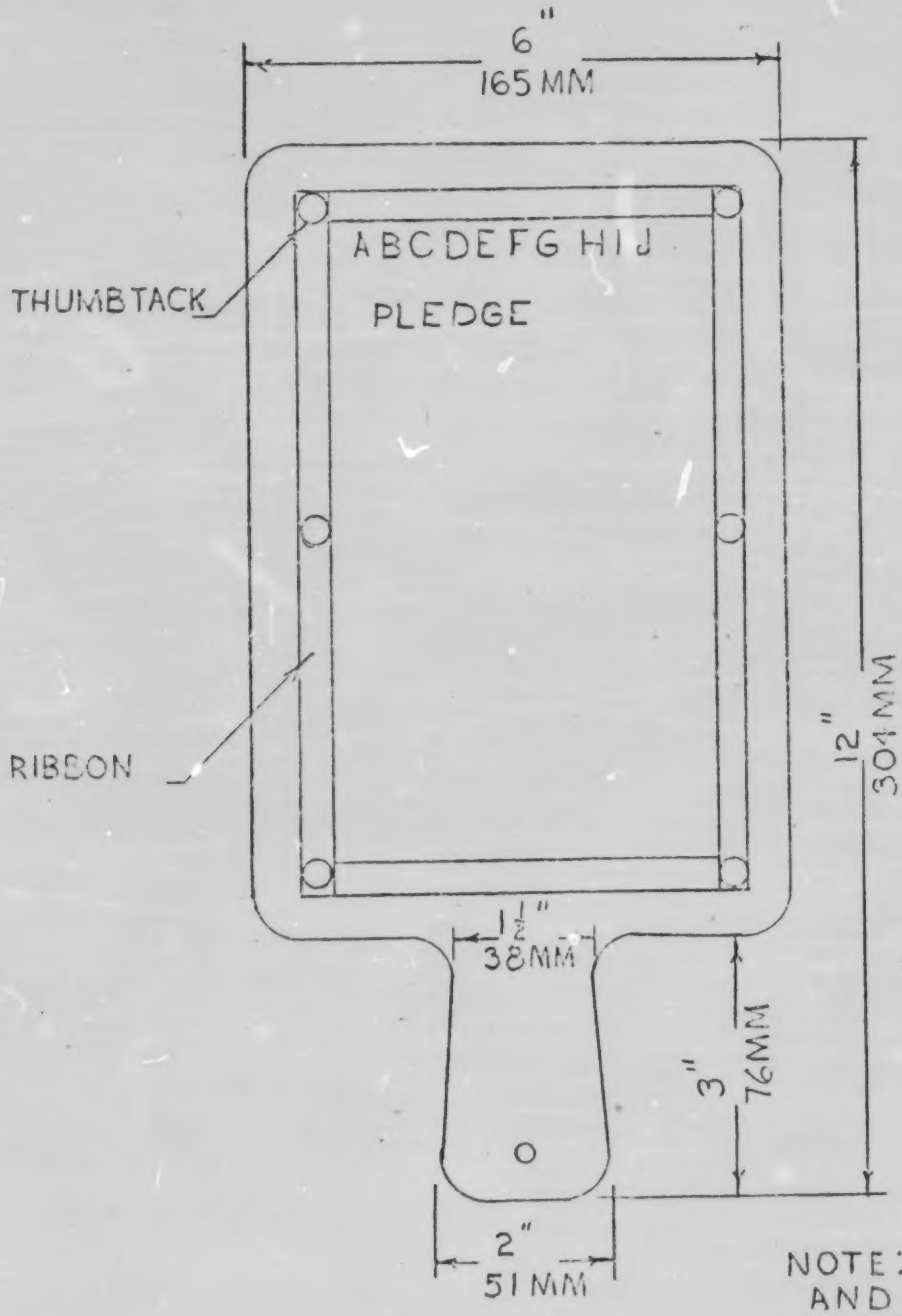
VI. Bill of Materials

1. 6" x ½" x 12" - #2 pine - (each project)
2. 6" x 1/8" x 12" - Masonite - (template)
3. Wood Stain
4. Paper (vellum)
5. Wheat paste
6. Modge-podge (non-toxic decoupage sealer)
7. Ribbon
8. Thumbtacks
9. Leather lace

VII. Tools Needed

1. Coping saw
2. Twist drill
3. Hand drill
4. File
5. Sandpaper
6. Crosscut Saw
7. Paint Brush
8. Rags
9. Hammer
10. Ruler
11. Pencil
12. Try Square

PILGRIM PRIMER HORN BOOK - GRADE 2



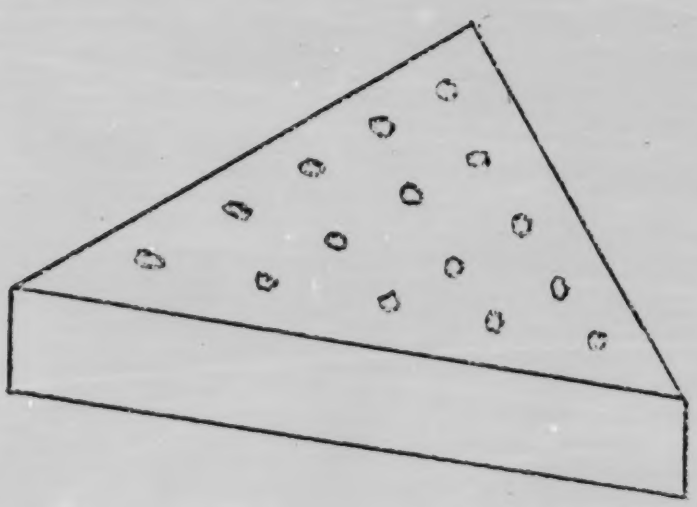
NOTE: ALL FILLETS AND ROUNDS ½" (12.3 MM).
STOCK-½" (12.3 MM) THICK.

I.Q. GAME

The game is played by first placing fourteen golf tees in the triangular shaped base. This will leave the game ready to start with one hole open. The object of the game is to leave as few tees as possible by jumping the tees one at a time without skipping any holes.

The game is constructed of pine and may be mass produced by using the jigs shown on the attached drawings. Clamping the jigs to a table and using a good back saw will aid the quality of the finished product. A drill stop is recommended over tape for mass production because of the large number of holes to be drilled.

After drilling the game may be sanded and finished. A clear satin finish will look very good if the wood has been sanded enough.



I.Q.GAME - SUGGESTED GRADE LEVEL - 3 & 4

I. Objectives:

Upon completion of this project the student will be able to:

1. Use and name a backsaw.
2. Use and name a miter box.
3. Use "C" clamps.
4. Use a hand drill and drilling jig.
5. Name the specialized processes involved in this mass production process.

II. Developemental tasks facilitated by this project:

1. Eye-hand coordination.
2. Fine and gross motor control.
3. Sequence of events.

III. Integration of project with other subject areas:

1. Math-counting and geometry.
2. Social Studies-the mass production process.

IV. How project facilitates Career Education:

1. Exposure to the world of work.
2. Demonstrates quality control.

V. Procedure :

1. Obtain necessary tools.
2. Prepare jigs.
3. Clamp wood in miter jig and make outside cut.
4. Make inside cut.
5. Use drilling jig and drill holes.
6. Sand with medium grit paper.
7. Sand with fine paper.
8. Coat with Polyurethane.

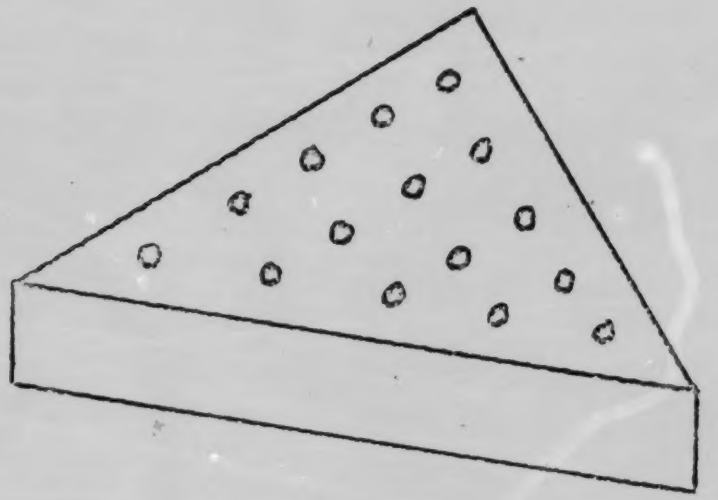
VI. Bill of materials:

1. 1"x5" #2 pine-length dependent on number of games.
2. Brush on Polyurathane.
3. 3/16" dowels

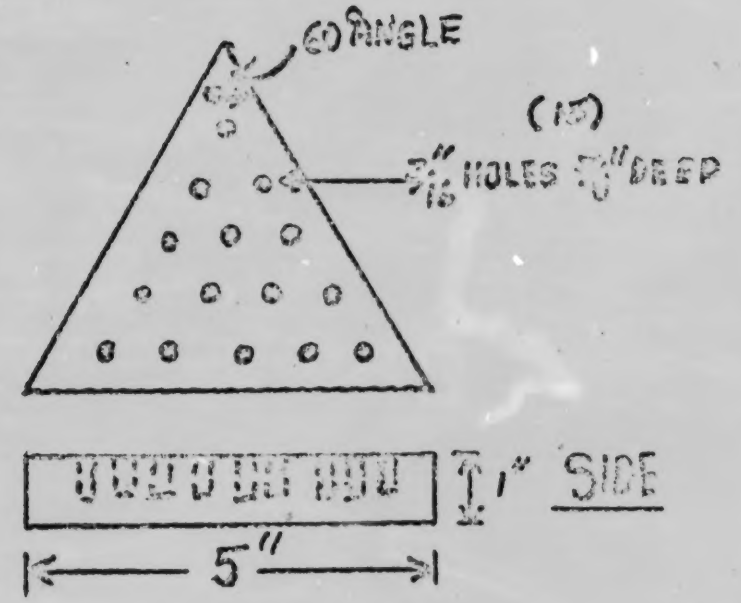
VII. Tools needed:

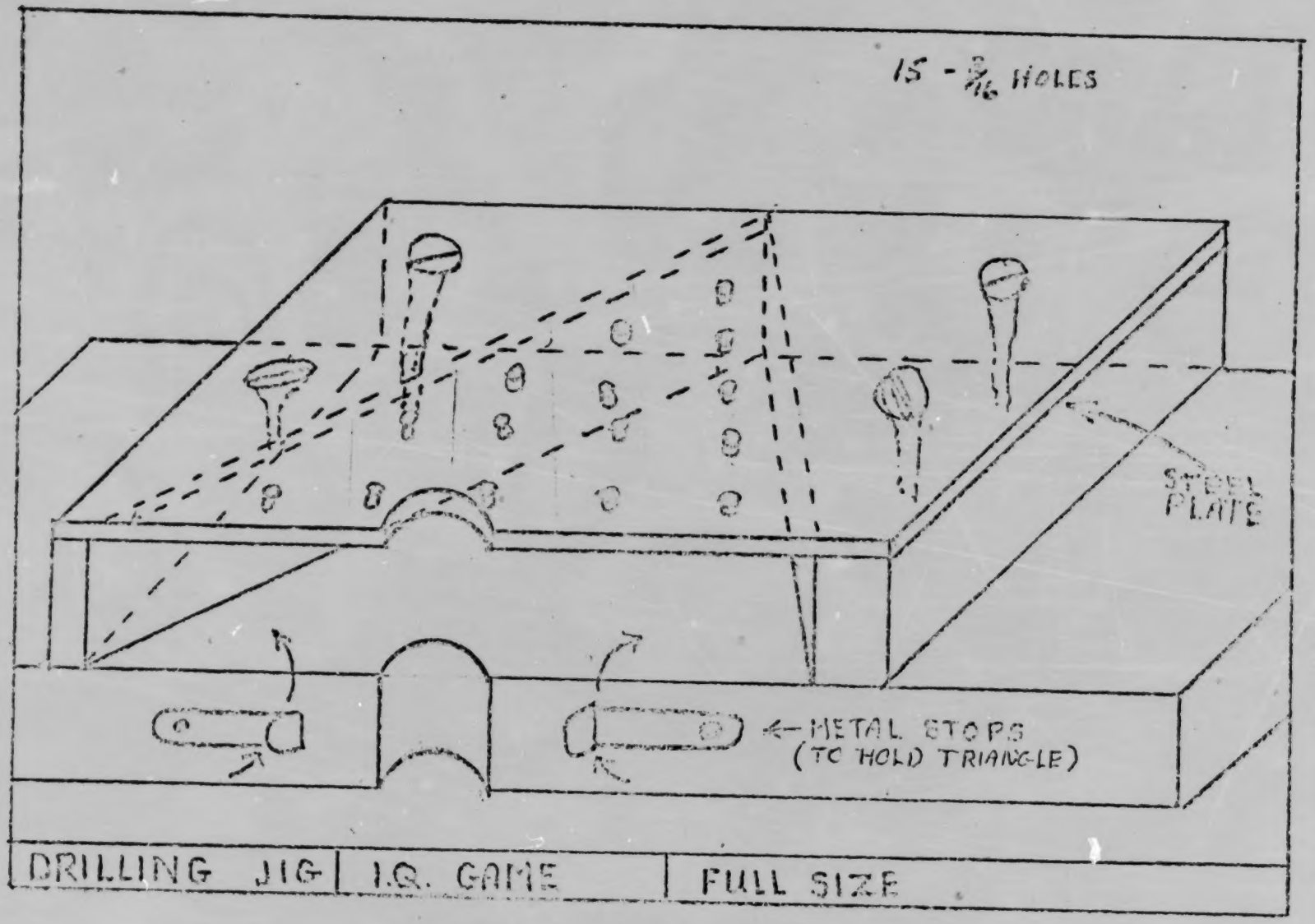
1. Miter jig
2. Drilling jig
3. Hand drill
4. 3/16" drill
5. Sand paper
6. Backsaw
7. 1" paint brush
8. Drill depth gunge collar

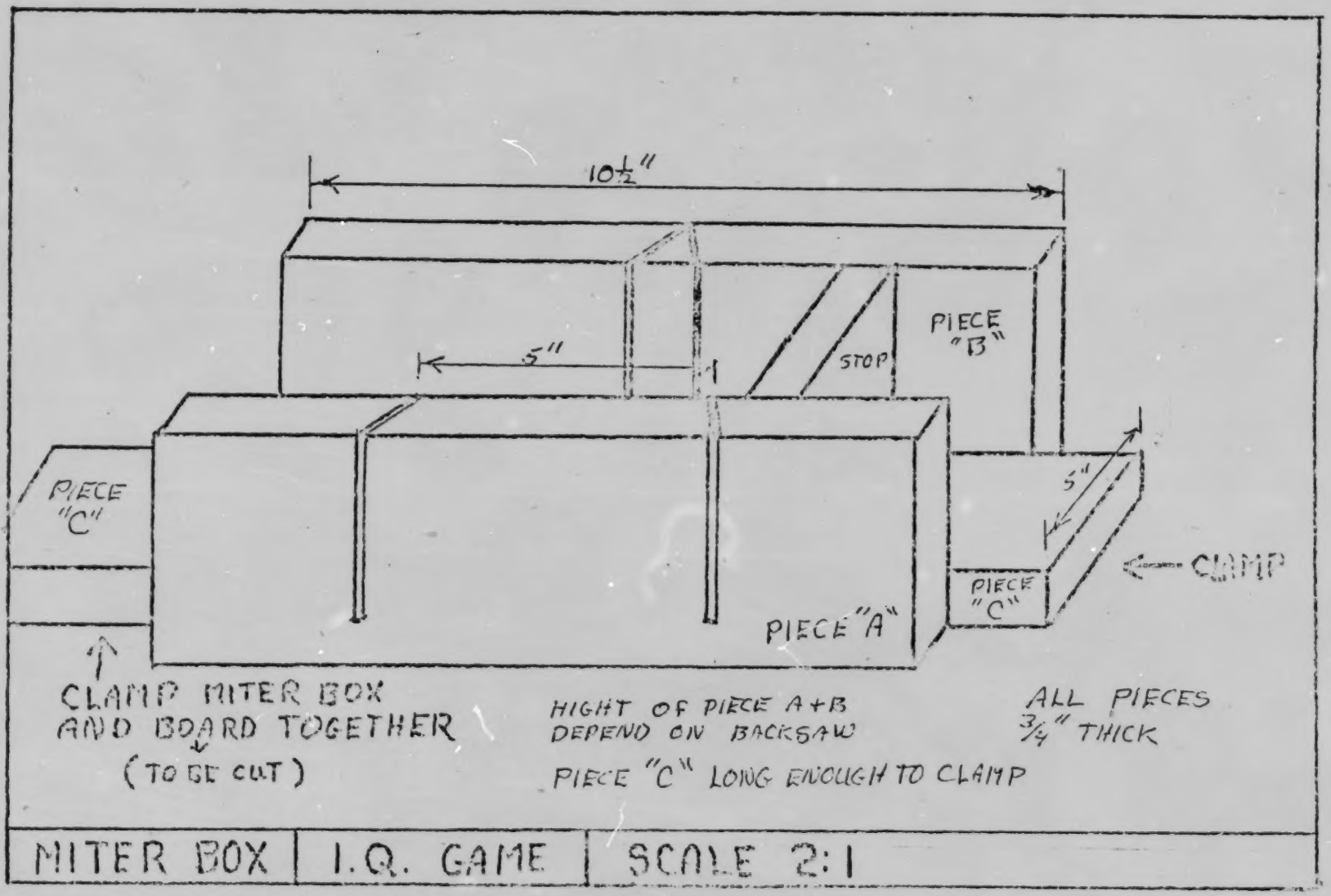
I.Q. GAME



TOP




15 - 3/16 HOLES
STEEL PLATE
← METAL STOPS (TO HOLD TRIANGLE)
DRILLING JIG
I.Q. GAME
FULL SIZE


10½"
5"
STOP
PIECE "B"
PIECE "C"
5"
CLAMP
PIECE "C"
PIECE "A"
CLAMP MITER BOX AND BOARD TOGETHER
(TO BE CUT)
HIGHT OF PIECE A+B DEPEND ON BACKSAW
PIECE "C" LONG ENOUGH TO CLAMP
ALL PIECES ¾" THICK
MITER BOX
I.Q. GAME
SCALE 2:1

ELECTRIC LIGHT BULB QUIZ

I. Objectives

Upon completion of this project the student will be able to:

1. Properly use a ruler as a measuring tool.
2. Properly use a try-square.
3. Properly use a hand saw.
4. Draw a simple schematic of an electrical circuit.

II. Developmental tasks facilitated by the project:

1. Eye-hand coordination.
2. Auditory discrimination by listening to and following directions.
3. The students imagination and academic skills will improve by making up questions and answers to play the game.

III. Intergration of project with other subject areas:

1. Science can be taught by using a unit on electricity to explain how and why the game works.
2. Because of the nature of this project almost any subject can be incorporated, depending on the type of questions asked.

IV. How project facilitates Career Education

1. Occupations related to the electrical field can be discussed.
2. The materials needed to product this project and the occupations that relate to them can be discussed. (i.e., wood - lumberjacks, etc.)

V. Procedure

1. Obtain necessary tools and materials.
2. Measure 8" x 12" on wood and mark.
3. Using a try square, draw straight lines to the desired length.
4. Clamp wood to bench.
5. Cut out shape with crosscut saw.
6. Smooth entire piece of wood with sandpaper or surform.
7. Measure in 2" from each end and mark.
8. Using the try square, draw lines the length of the board (on the 2" marks).
9. Measure down 2" and mark.
10. Place the try square at the side of the wood and draw a line across the board to the other side.
11. Measure down $1\frac{1}{2}$" from the previous line and mark. (repeat this procedure until six lines have been drawn).
12. Measure in 4" from one side and $1\frac{1}{2}$" from the top and mark.
13. Drill a 3/8" hole in the center of the mark in step 12.
14. Drill a 1/16" hole in each of the 12 other marks where the lines intersect.
15. Paint or stain the board.

V. Procedure:

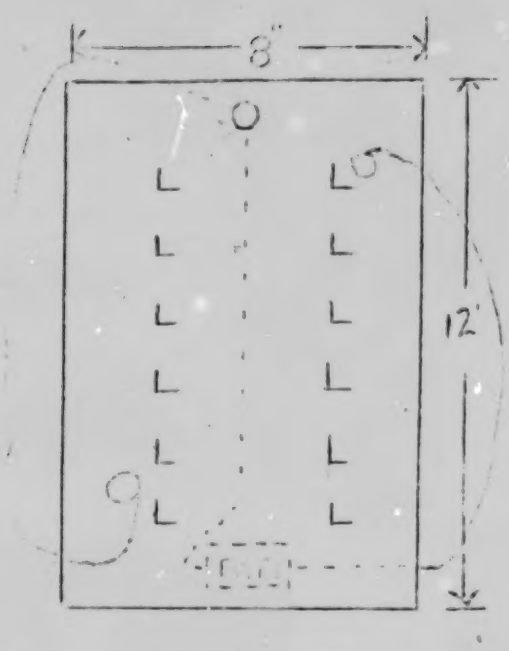
1. Obtain necessary tools and materials.
2. Measure 8" x 12" on wood and mark.
3. Using a try square, draw straight lines to the desired length.
4. Clamp wood to bench.
5. Cut out shape with crosscut saw.
6. Smooth entire piece of wood with sandpaper or surform.
7. Measure in 2" from each end and mark.
8. Using the try square, draw lines the length of the board. (on the 2" marks)
9. Measure down 2" and mark.
10. Place the try square at the side of the wood and draw a a line across the board to the other side.
11. Measure down 1½" from the previous line and mark. (repeat this procedure until six lines have been drawn).
12. Measure in 4" from one side and 1½" from the top and mark.
13. Drill a 3/8" hole in the center of the mark in step 12.
14. Drill a 1/16" hole in each of the 12 other marks where the lines intersect.
15. Paint or stain the board.
16. Fasten cup hooks in each of the small holes.
17. Measure a 16" piece of wire, cut and strip the ends.
18. Wrap one end of the stripped wire around the light bulb and insert through the large hole at the top.
19. Turn board over and attach wire to each end of the cup hooks. Make sure that the wires do not go directly across to each other. (the wire should first be cut to length and stripped at both ends.)
20. Place a piece of cardboard over the back of the wires and tape in place.
21. Tape battery to the back of the board.
22. Make a loop in the loose end of the light bulb wire.
23. Attach another piece of wire to the bottom of the light bulb and secure in place with a piece of tape. Place the other end of the wire to one side of the battery.
24. Attach another piece of wire to the other end of the battery, fasten with tape and make a loop in the other end.
25. Make up questions and answers and attach to the appropriate hooks.

VI. Bill of Materials

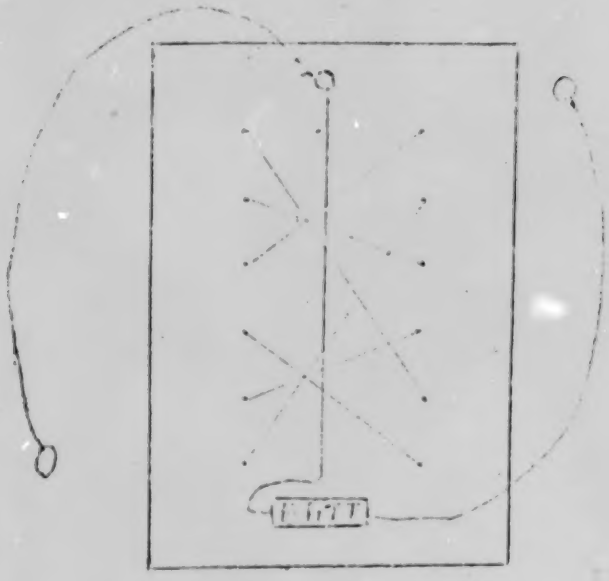
1. 1 pc. ¼" x 8" x 12" plywood.
2. 16 cup hooks 3/4"
3. 7½' of coated wire
4. 1 "D" cell battery
5. 1 flashlight bulb
6. Spray paint
7. Masking tape

VII. Tools Needed

1. Crosscut saw
2. Hand drill
3. Drill bits, 1/16" and 3/8"
4. C-clamp
5. Try square
6. Ruler
7. Dikes or wire strippers
8. Surform
9. Sandpaper 100 grit



FRONT



REAR

SCALE ¼" = 1'

Airplane--Suggested Grade Level 5

I. Objectives
Upon completion of this project, the student will be able to:
1. Use a coping saw to cut out the shape of wings.
2. Use templates to trace shapes.

II. Developmental tasks facilitated by this project:
1. Eye-hand coordination
2. Developing of individuality

III. Integration of the project with other subject areas:
1. Current events: Information regarding innovations in air travel, for instance, space shuttle.
2. History: Progress and development of the airplane.
3. Science: Describe what forces an airplane must overcome in order to become airborne.
4. English: Common terms related to flying such as aerodynamics bank, drag, lift, and thrust.

IV. How project facilitates career education:
1. Emphasize that an airplane could be a beginning step in learning model making. Hobbies can bring a person in touch with activities and experiences that help in making career choices. Since modelmaking, as a hobby, can be rewarding experience, a student's participation in this modelmaking project will allow him to possibly join a modelmaking club or enter a local modelmaking contest. The opportunities and exposure from such particapation could possibly give the student incentive to further delve into other subject matters and open a world of information to himself.

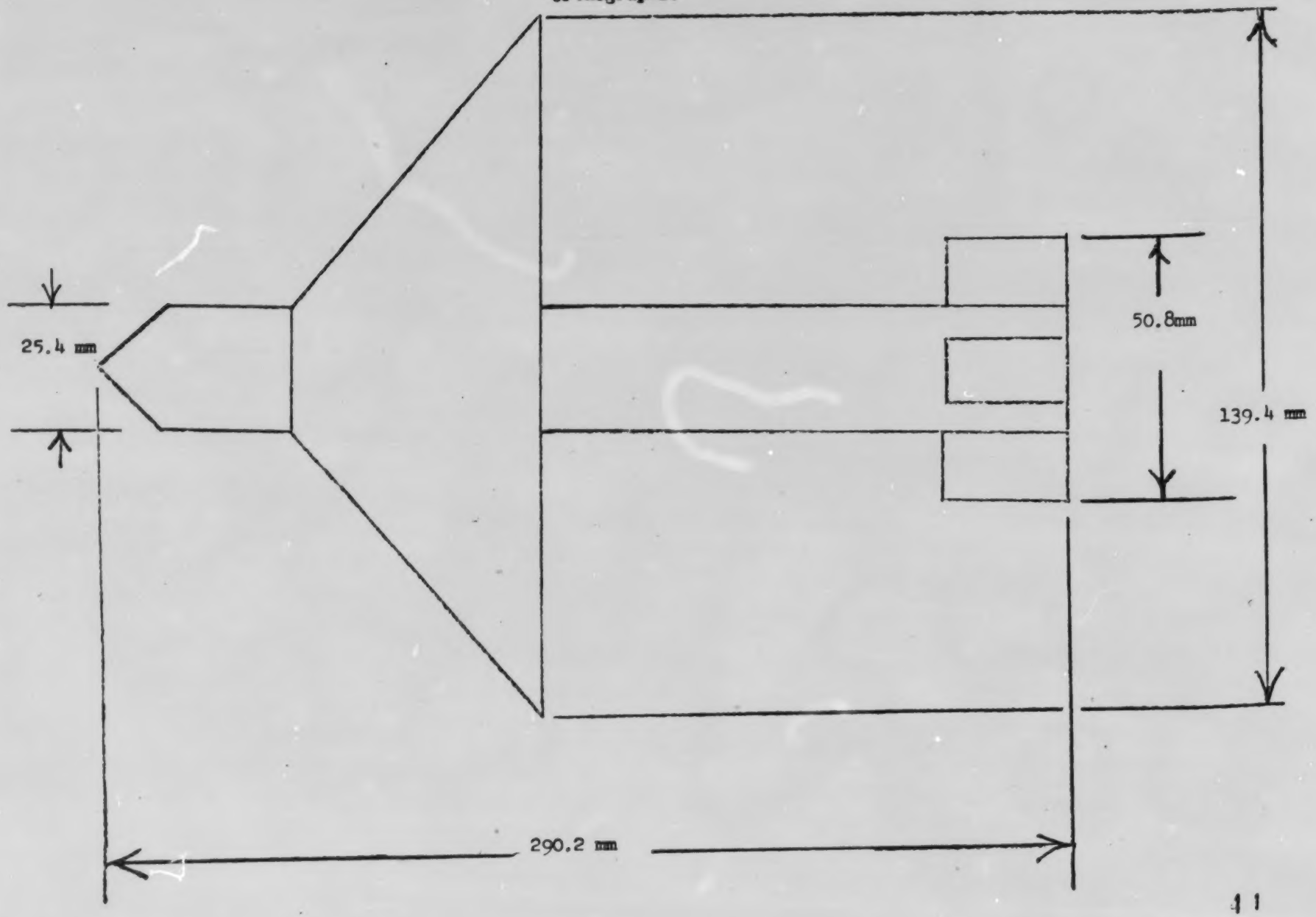
V. Procedure:
1. Obtain necessary tools, materials and templates
2. Use template to trace wings
3. Use coping saw to cut out wings
4. Use coping saw to cut airplane body
5. Use coping saw to cut spool threads in half
6. Sand all pieces smooth
7. Glue wings to airplane
8. Glue spool threads to body
9. Paint

VI. Bill of Materials:
1. One piece of one inch dowel, eight inches long
2. One piece of one quarter inch plywood, ten inches by ten inches
3. Three empty thread spools
4. Glue
5. Water base paint
6. Brush

VII. Tools required:

1. Coping saw
2. Ruler
3. Pencil
4. Vise

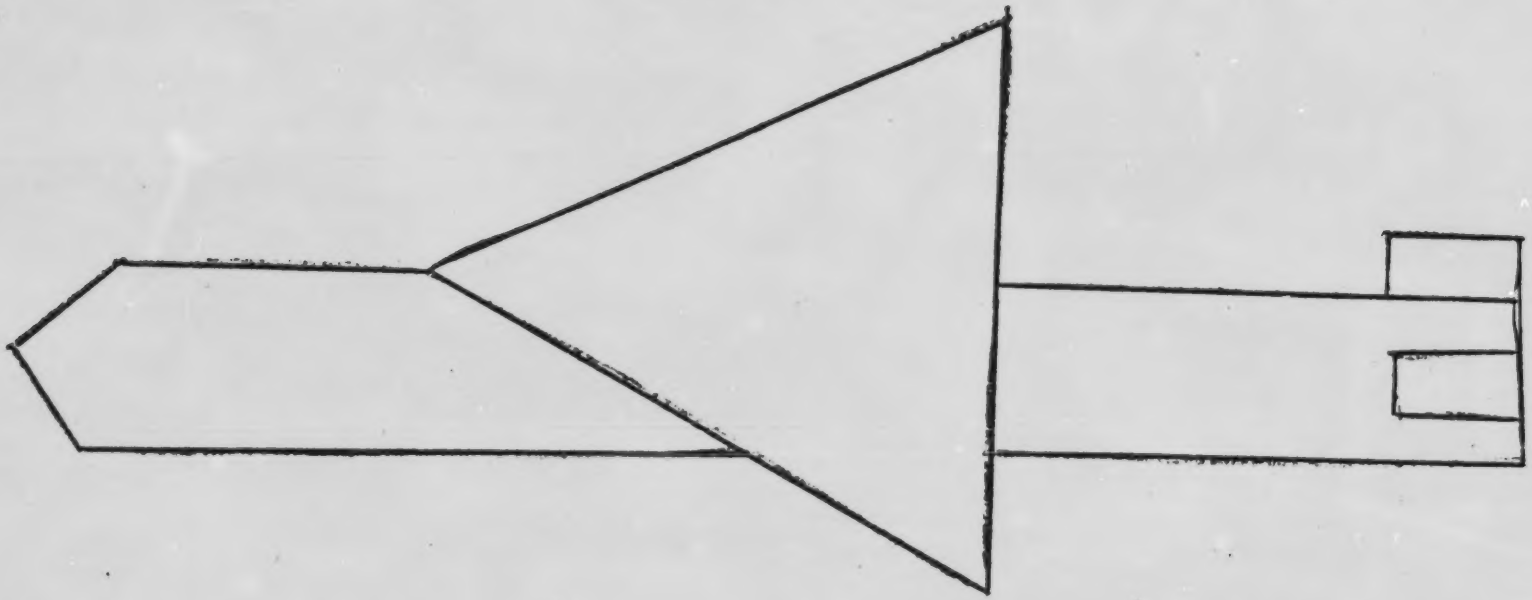
Dimensioned
Orthographic



43

41

Pictorial View



BASIC CANDLE - SUGGESTED GRADE LEVEL 4-5

I. Objectives:

Upon completion of this classroom project, the student will be able to:

1. To cut or break colored wax chunks into small irregular shapes.
2. Drop chunk wax into the bottom of the mold to a depth of approximately two inches.
3. Pour melted wax to within one-half inch of top of the chunk wax.
4. Cut flat braid wick ten inches in length.

II. Developmental Tasks Facilitated by this Project:

1. Fine muscle control.
2. Eye-hand coordination and separation.
3. Greater independence in performing activities on students behalf (self-awareness)
4. Ability to accurately measure and record data.
5. Greater individual responsiblility.

III. Intergration of Project with other Subject Areas:

A. Mathematics:

1. Metric system.
2. Measuring, estimating.
3. Addition and substraction

B. Language Arts:

1. Vocabulary related to the different types of waxes; following written directions of making a candle.
2. A written report on the history of the candle.

C. Social Studies:

1. How the candle was invented.

2. Usage of the candle.

D. Science:

1. Study of different types of waxes.

2. The ingredients of the wax.

3. Chemicals used in dying the wax.

E. Fine Arts:

1. Create different candle molds.

2. Different color schemes through the use of dyes.

IV. How Project Facilitates Career Education:

1. An interesting hobby or pastime can lead to a career.

2. Different careers with candlemaking.

3. A school subject intergrated with other Industrial courses; for example, leathermaking and jewelry.

4. The importance of the candle in past history.

V. Procedure:

1. Obtain necessary tools and materials.

2. Make sure mold is thoroughly clean and dry.

3. Insert the wick in bottom of mold.

4. Pull it over the top of the mold and insert the wick screw.

5. Hold wick taut and turn the screw clockwise.

6. Turn mold right side up.

7. Pull wick taunt and tie it to wick bar.

(wick must be in center of mold)

8. Melt wax in double-boiler.
9. Add one cube of scent and one cube of dye per pound of wax.
10. Stir to distribute the dye.
11. Place the mold on a cookie sheet and pour wax into mold slowly and carefully.
12. Save two cups of wax to fill the well left by shrinkage.
13. Let cool for one hour, insert pencil into wax around the wick to relieve the pressure caused by wax shrinkage.
14. Let cool for 30 minutes.
15. Reheat left over wax and pour into well that has formed.
16. Let candle cool at room temperature overnight or at least 8 hours.
17. Remove candle:
    a. remove the wick screw from bottom of mold and hold mold under hot, running water for a few minutes.
    b. pull wick bar gently.
    c. cut wick loose from wick bar after the candle is out of the mold.

VI. Bill of Material:

1. 3" x 7" polypropylene mold.
2. 2 lbs. treated candle wax.
3. 4 feet of 30-ply flat braid wick.
4. Wick screw and wick bar.
5. Red color tablets.

6. Blue.

7. Yellow.

8. Rose scent tablets.

9. Flat drying block or cookie sheet.

10. Scissors.

11. Double-burner.

12. All material needed in Candle Craft Kit (Cunningham Art Products, Inc., 1564 McCurdy Drive, Stone Mountain, GA 30083)

VII. Tools Required:

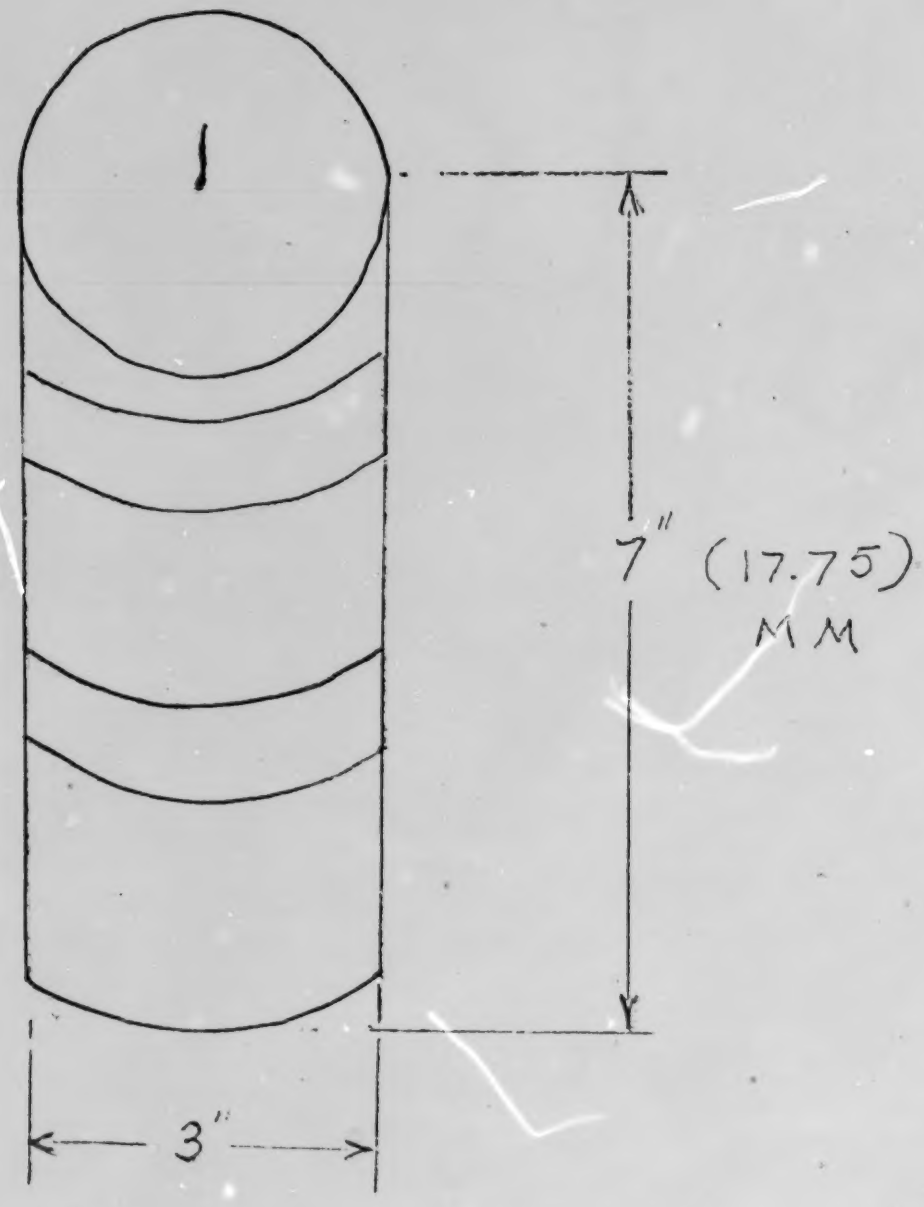
1. Ruler.

2. Pencil.

3. Scissors.

4. Double-burner.

BASIC CANDLE



A Simple Kite Activity for The Sixth Grade

Objectives:

The students will demonstrate their ability to construct a kite by performing the following tasks:

1. Use a ruler to measure a given distance.
2. Use templates to trace shapes on paper.
3. Use a pair of scissors to cut out the shape which was traced.
4. Use a coping saw to cut sticks to length which were marked out earlier.
5. Use sandpaper to sand the boards to a smooth finish.
6. Fly the kite for five minutes.
7. Determine the amount of particulate matter that is in the atmosphere.

Developmental Tasks Facilitated By This Project:

1. Fine muscle control which is needed to construct the kite.
2. Social skills which are brought out in the group activity through cooperation and friendliness.
3. Concrete learning is attained through a better understanding of environmental pollutants and what can be done to pre-

vent further damage to the atmosphere.

4. Self-awareness is shown when the student realizes his limitations through his successes and failures.
5. Following instructions is essential in any task one may undertake.

How The Project Can Be Integrated With Other Subjects:

1. Science
   a. Wind currents.
   b. Weather experiments.
   c. Pollution experiments.
2. History
   Origination of kite flying.

How The Project Facilitates Career Education:

1. Students perform experiments dealing with weather conditions and are introduced to the Meteorological profession.
2. Students perform experiments dealing with pollution in the environment and are introduced to the Environmental profession.
3. Students relate the causes for pollution to the automobile industry and what is being done by them to prevent further damage, thus sparking an interest in the redesigning of our current modes of trans-

portation.

4. Students can also relate the causes of pollution to various other industries and might become interested in the search for alternative sources of energy.

Procedure:

1. The instructor will pre-cut the stock.
2. Measure stick A to length and cut it with a coping saw.
3. Measure stick B to length and cut it with a coping saw.
4. Locate the center at each end of stock A and B.
5. Place the stock upwards in the vise and cut a 1/2" notch in each edge of A and B. (see figure A)
6. Sand the sticks to a smooth surface finish.
7. Begin assembling the kite by:
   a. Measuring along the stock A 27" and placing a mark.
   b. Locating the center of stock B and placing a mark.
   c. Crossing two sticks and tying them together tightly with string.

8. Place a cardboard template on paper and trace the sail. (see figure C)
9. Cut out the paper with a pair of scissors.
10. Locate and fold the seams using a metal straight edge to locate the crease.
11. Apply glue to the edge of the seams.
12. Measure string to length.
13. Insert the string into the seam.
14. Fold the seam over the string making sure the string does not become caught in the glue.
15. Attach the seams to the frame by inserting the string into the notches of the precut stock.
16. Tie 18" string taut between ends of crossstick B so that it bows 4".
17. On front side of kite (see figure E) measure 2" down and 8½" up center of kite.
18. Tie 30" string through paper to stick. (see fig. E)
19. Tie ball of flying string one-third distance down from top of string , as shown in figure E.

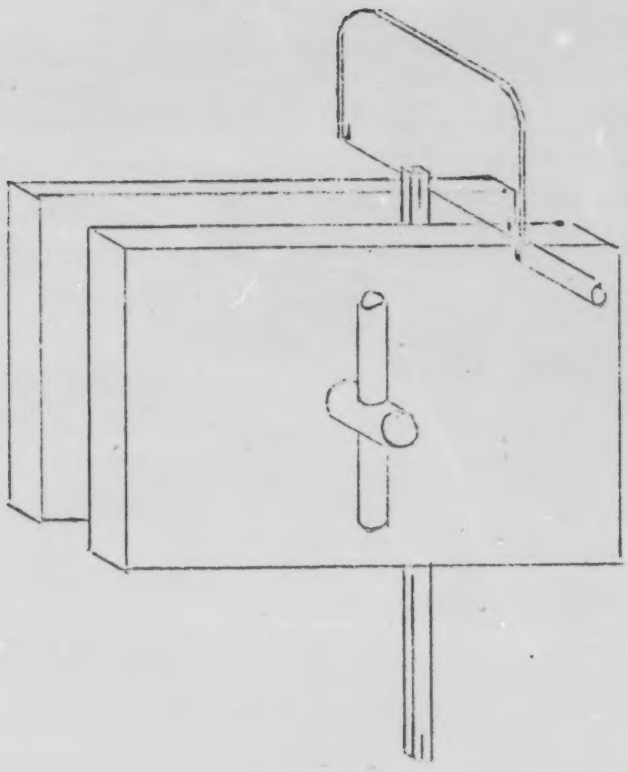
A Bill of Materials to Build a Kite

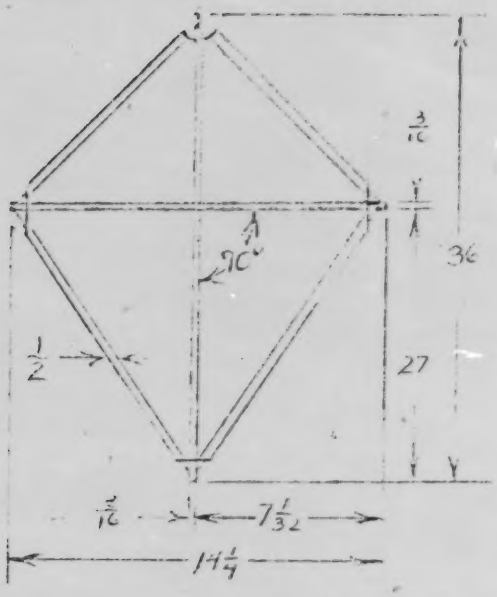
Number	Materials	Thickness	Width	Length
1	Piece of kite paper		16"	38"
1	Pine stick (A)	3/16"	7/16"	36"
1	Pine stick (B)	3/16"	7/16"	11¼"
2	Balls of string			
1	Piece of string			30"
1	Piece of string			18"
1	Piece of string			6½'
1	Tube of glue			
1	Piece of #120 sand-paper			
1	Piece of cardboard for template	1/16"	16"	38"

Tools Needed For The Project

1. Coping Saw
2. Knife
3. Pencil
4. Straight edge 36"
5. Vise
6. Ruler
7. A pair of scissors
8. Hole puncher 1/16" diameter

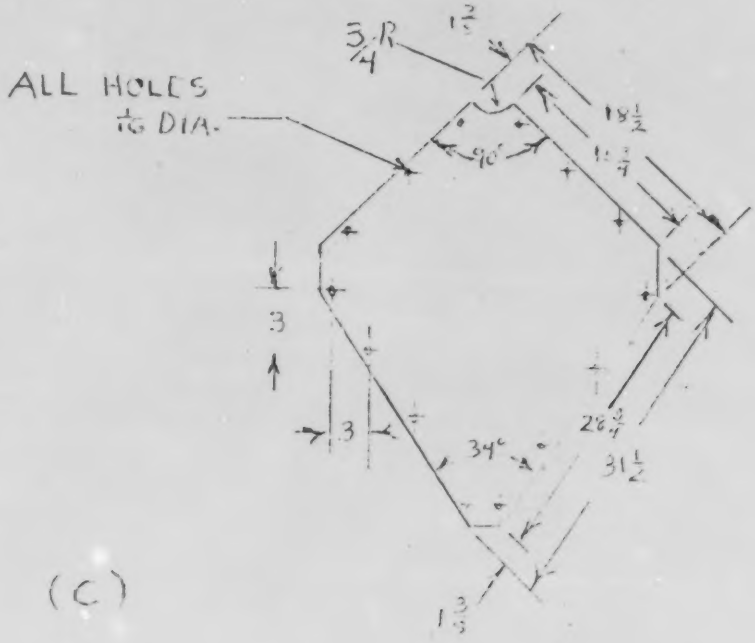
(A)





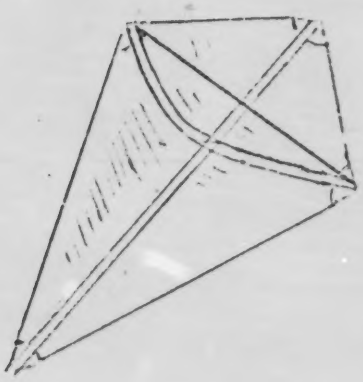
(B)

CARDBOARD TEMPLATE



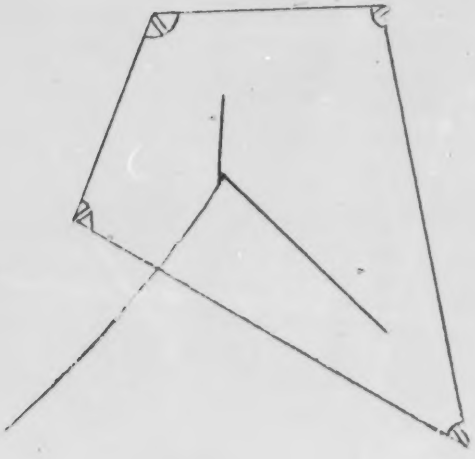
(C)

BACK SIDE



(D)

FRONT SIDE



(E)

A Proposed Experiment To Be Performed When Kite Flying

Air pollution is a much discussed topic. The particles of matter released into the atmosphere by human activity are one major form of air pollution. In this investigation you determine the amount of particles in the atmosphere.

Objectives

Upon completion of this investigation most students should be able to determine the amounts of particle matter that are in the atmosphere.

Procedures

1. Measure and cut out a 10 centimeter square of plastic wrap.

2. Find the area of the plastic wrap (multiply the length by the width) and record it in a notebook.

3. Place a piece of masking tape on each corner of the plastic wrap.

4. Apply a smooth, even coating of petroleum jelly to the surface of the plastic wrap.

5. Weigh and record the weight of the coated plastic wrap to the nearest hundredth of a gram. Do not touch the coating once the wrap has been weighed.

6. Tape the coated side up to the underside of the kite.

7. Fly the kite for as close to an hour as possible and try to get the kite as high into the atmosphere as possible.

8. Once the kite has been pulled in, determine any change in weight that has occurred during the exposure time. Record the answer in the notebook. (The answer is in grams/ square centimeter/ hour.

Interpretations

First, how much dust has been collected on the plastic during the exposure time. Second, how much dust could be collected in a day. Third, what the sources of particle pollution are in a given community.

Materials

1. Balance, sensitive to 0.01 grams.
2. Plastic wrap.
3. Petroleum jelly.
4. Masking tape.
5. Metric ruler.
6. Scissors.
7. Kite.

Further Activities

1. Place more than one piece of plastic wrap on the kite.
2. Fly the kite near an industrial park in town. Find out what the difference in the amounts of particle dust exist in the school yard as opposed to the industrial park.
3. Fly the kite in various other areas of town.

CANDLE HOLDERS – SUGGESTED GRADE LEVEL 6

I. Objectives

Upon completion of this project, the students will be able to:

1. Measure to within one sixteenth of an inch.
2. Measure and mark wood to the proper length.
3. Use the miter saw to cut wood to the proper length.
4. Locate the center of a piece of wood that is two and one half inches wide.
5. Use dividers to form a radius.
6. Use the coping saw, to cut shapes.
7. Use the block plane.
8. Use the files to shape wood.
9. Use the bit brace and correct size boring bits.
10. Use electric hand sanders and know how to sand wood.
11. Use a hammer.
12. Apply an oil stain finish.

II. Developmental Tasks Facilitated by this project

1. To develop an awareness of materials, tools, and processes and how they are use properly.
2. Fine muscle control and eye-hand coordination.
3. Develop safe working practices.
4. Develop social relationships such as cooperation, tolerance, leadership and behavior.
5. Develop an appreciation of good craftmanship and design.

III. Intergration of Project with other subject areas

1. Mathematics - measuring
2. Science - growth of trees and sources of wood products
3. Career Education - types of jobs and people involved with wood

IV. How Project facilitates Career Education

1. Develops an interest and insight into working with wood
2. Teaches students to work with others.
3. Teaches safety and proper tool uses.
4. Involves students in the development of good craftsmanship.
5. It gives the instructor a tool to help expand on all the areas and jobs that are related to wood.

V. Procedure

1. Obtain a piece of pine wood pre-cut to two and one half inches in width and over twelve inches long.
2. Measure wood to twelve inches in length.
3. Using the miter saw, cut to length. (twelve inches)
4. Using a ruler locate the center and draw a vertical line through it.
5. Using dividers, put a radius on the top of the wood
6. Using the coping saw, cut out the radius.
7. Block plane the edge grain.

8. File the half circle cut and the end grain
9. Use the electric hand sanders to sand the face of the wood
10. Use the dividers to put a radius on a piece of wood two and one half inches wide by two inches long. Draw a line from corner to corner to locate the center.
11. Use the coping saw to cut out the half circle.
12. File and sand the wood.
13. Obtain a piece of wood pre-cut to one and one quarter inches in width.
14. Cut it to length on the miter saw one and one half inches long.
15. Draw a light line from one corner to the other to locate the center.
16. Use the bit brace and a three fourths inch boring bit and bore a hole half way into the center of the one and one quarter inch piece of wood.
17. Sand and file all marks on the wood.
18. Round off all edges and finish sanding all pieces of wood
19. Use a one half inch flat head wood screw and secure the small piece of wood to the larger holder lining it up in the center
20. Measure up seven inches on the large backing board and use a square to draw a straight across. Measure up three quarters of one inch more and draw another straignt line.
21. Use a jig and fixture and line up the two pieces with the lines facing up.
22. Use a claw hammer and number four finish nails and nail the two pieces together.
23. Check for any marks on the wood and sand if necessary.
24. Apply oil stain finish, using a paint brush or rag.
25. Let the stain dry for fifteen to twenty minutes.
26. Apply coat of clear lacquer with a paint brush. Let it dry for twenty four hours.
27. Steel wool and wax the candle holder.

VI. Bill of materials

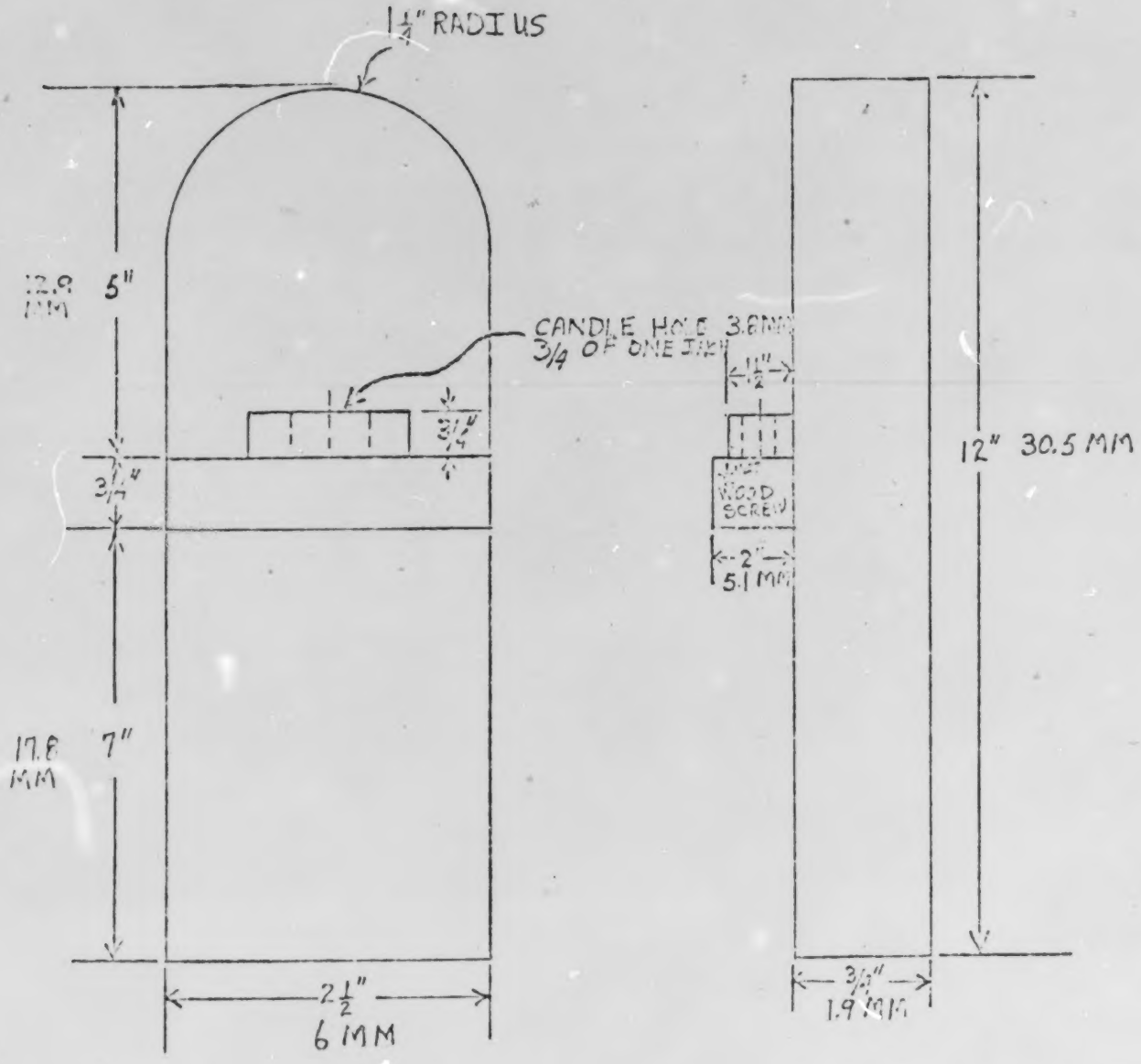
1. Three quarter inch pine - cut to two and one half inches in width. Length over twelve inches
2. One half inch flat head wood screws
3. Three quarter inch pine cut to one and one quarter inch width. Length over one and one half inches in length.
4. Number 4 finish nails.
5. Oil base stain, and clear lacquer.

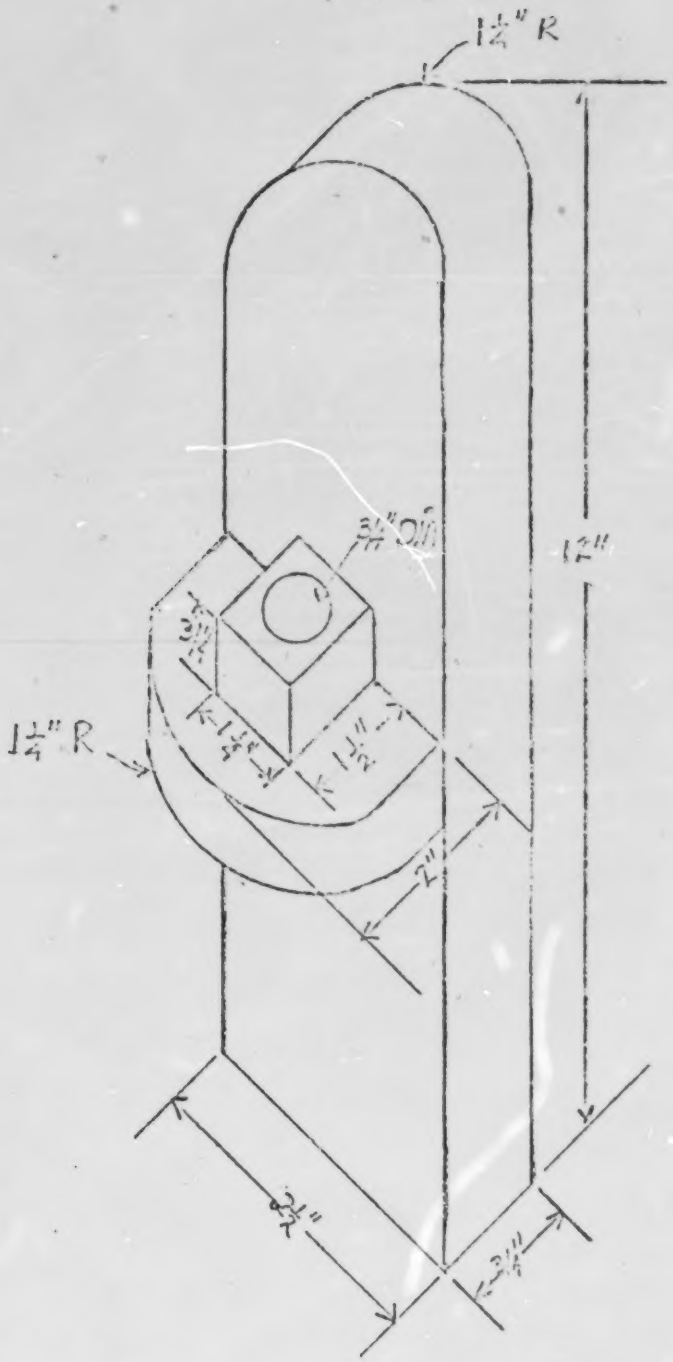
VII. Tools needed

1. Ruler
2. Coping saw
3. Block plane
4. Electric sanders - belt and vibrating
5. Claw hammer
6. Screw driver
7. Divides

8. Pencil
9. Try square
10. Paint brushes
11. Oil base stain
12. Clear lacquer
13. Paint and lacquer thinner

WALL CANDLE HOLDER




1¼" R
¾" Dia.
12"
¾"
1¼" R
1¼"
1¼"
2"
3¾"
3¾"

SILK SCREEN PRINTING

1. Objectives

Upon completion of this project the student will be able to -

a. Trace a design of lettering
b. Make a stencil
c. Cut out the stencil with a stencil knife
d. Use a screen unit
e. Spread paint using a squeegee

2. Developmental tasks facilitated by this project.

a. Fine muscle control
b. Eye-hand coordination
c. Independent thought
d. Decision making

3. Integration of this project with other subject areas

a. Math - Centering the work area
b. Art - using paint and making designs
c. English - working with words
d. History - how Screen Printing was done in the past.
e, Science - working with different paints and materials

4. How this project facitates career education

a. How different signs are made
b. How this is done in industry

THE PAPER STENCIL METHOD

The paper stencil is one of the most simple of all silk screen methods. A paper mask is fastened to the silk screen and those areas which are to print are trace-cut. The paint or color is forced through these areas by the squeegee, while the rest of the paper acts as a block-out medium.

The paper stencil is best for work involving simple designs or lettering on large areas. Store circulars, card signs (in quantities up to 200), real estate signs, display panels, outdoor posters (up to 24 sheet size), streamers, flags, banners and pennants are some of the most popular uses of the paper stencil method. The paper used for the stencils is not expensive and the stencils are easy to prepare. Fig. 1 shows various samples of poster work which are adpatable to the paper stencil method.

Materials and Tools

Besides the regular screen unit and paint, the following will be needed:

BOND PAPER. This should be a thin, transparent grade, so that the design may be viewed through it without difficulty. Tympan paper used by printers is excellent for stencils. The paper used to back a duplicating machine stencil is a variety of this tympan paper. There is also a commercial product available, made specifically for this purpose. It is a heavy, tough paper, thoroughly waxed with a hard wax, and transparent.

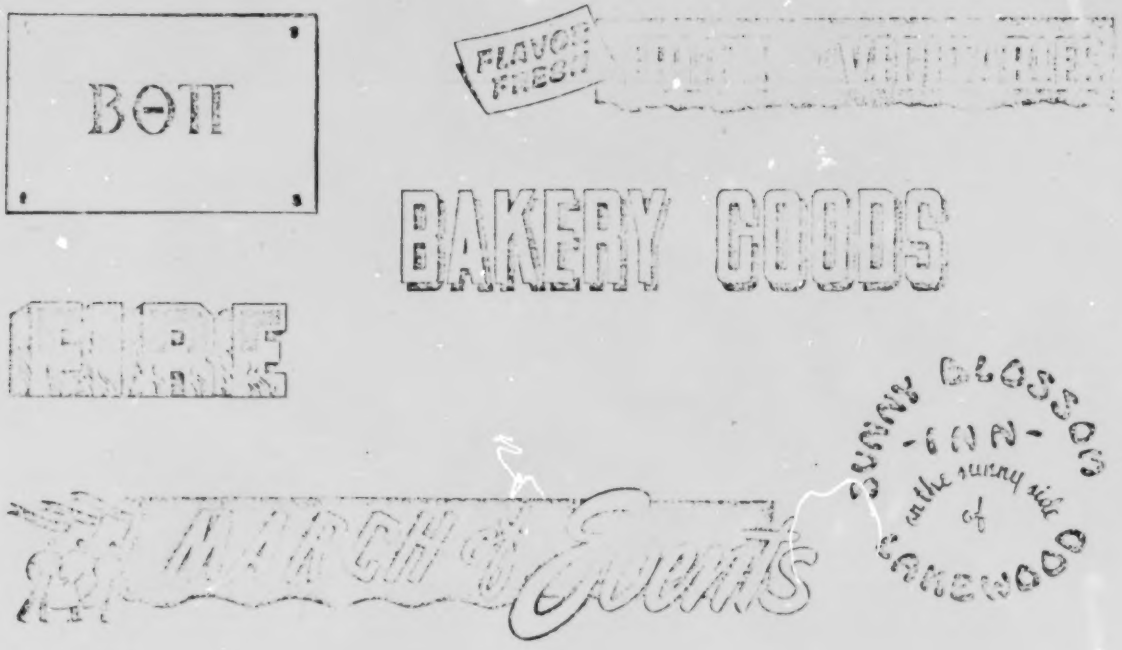


Fig. 1. Samples of Paper Stencil Screen Printing

Stencil knife. This will be used to trace-cut the lettering or design on the bond paper, Fig. 2.

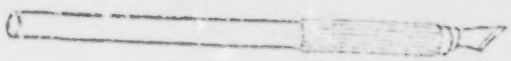


Fig. 2. Stencil Knife

Cellophane or masking tape. These are adhesive tapes requiring no moistening. Tape will be used to fasten the stencil paper over the original and also to the screen.

Kerosene. This will be used to clean the screen when the printing is finished. It is inexpensive, easy to obtain, and does a good job.

Cloth. This will be soaked in the kerosene and used to clean the screen.

Procedure

1. Place the copy to be reproduced directly under the screen, Fig. 3. Register it as shown.

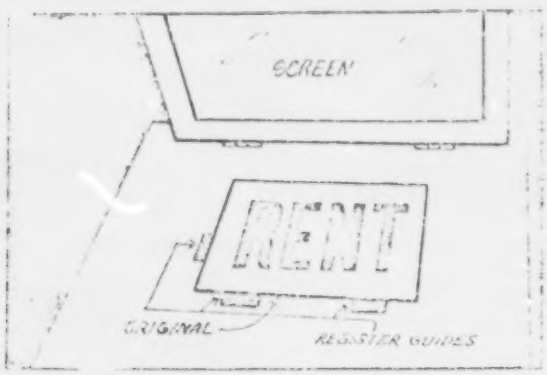


Fig. 3. Original Registered on Printing Surface

2. Cover the orginal with bond or kraft paper and tape it at the corners to hold it securely in place, Fig. 4. Wipe the surface of the paper with a cloth soaked in kerosene. This makes the paper translucent, so you can see the original through the paper.

NOTE: When the commercial waxed paper is used, this last process is not required.

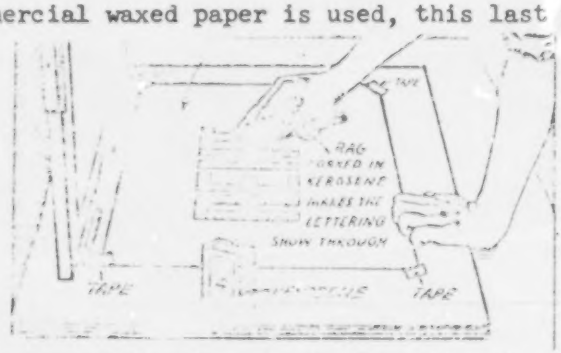


Fig. 4. Kerosene-Moistened Paper is Translucent

3. Trace-cut the lettering with the stencil knife. Follow the edge of the lettering or design carefully, for any mistakes will be reproduced, Fig. 5. Allow the letters to remain in place after the paper is cut through.

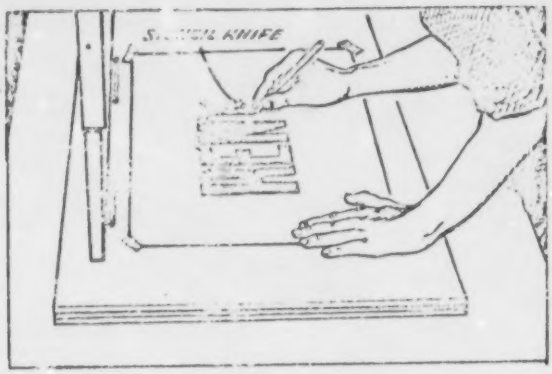


Fig. 5. Cutting the Stencil

4. Lift the tape from the corners of the paper. Be sure that the paper does not move out of register with the original copy, Fig. 6.

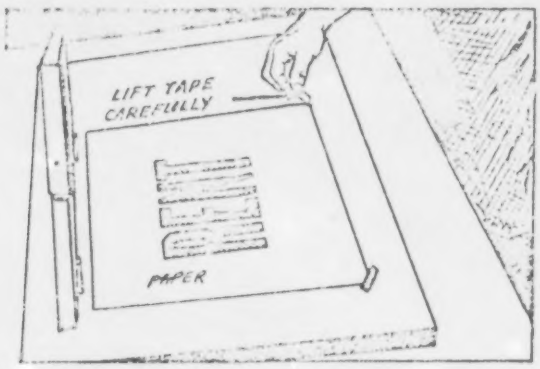


Fig. 6. Remove Tape, But Do Not Move the Paper

5. Lower the screen frame, add heavy paint and pass the squeegee across the screen. The paint actas as the adhering agent for the paper stencil, Fig. 7.

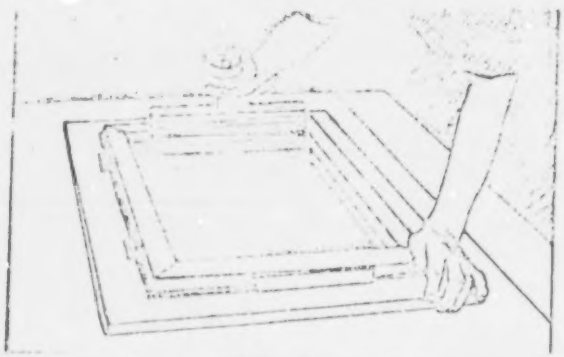


Fig. 7. Adhere Paper to Screen With Heavy Paint

6. Carefully lift out the letters, or the parts of the design that are to print, Fig. 8.

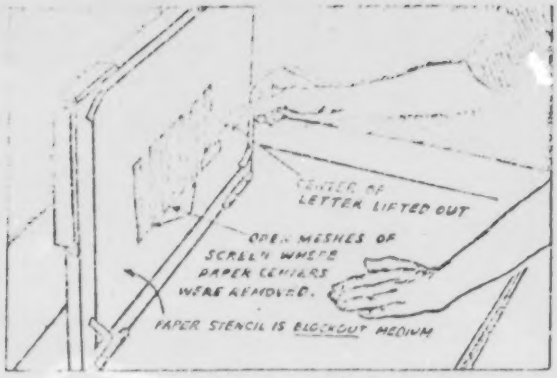


Fig. 8. Remove Printing Portions

7. Place a blank card in proper position for printing, Fig. 9. Lower the screen and force the color through the screen by passing the squeegee over the surface.

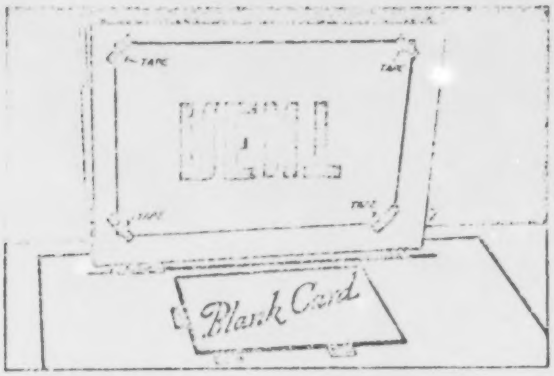


Fig. 9. Blank Card in Position for Printing

8. Raise the screen, remove the printed card, and insert another blank in register, Fig. 10. Print rapidly so that the screen mesh will not become clogged with paint.

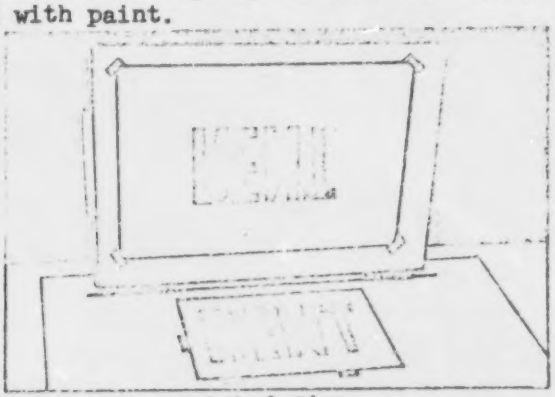


Fig. 10. Printed Sign

Additional Hints

1. As compared to other types of stencils, the paper stencil is limited to the relatively short life of the paper itself. This is especially true if a water base paint is used. Therefore, this method is recommended mainly for short runs.

2. Occasionally paint will be forced under the stencil, between the stencil and the silk, eventually leaking out onto the printing surface. This can be prevented by fastening the stencil down on all four sides with gummed tape, thus sealing the edges.

INFORMATION SHEETS FOR USE IN A WORKSHOP TO BE CONDUCTED BY AN INDUSTRIAL ARTS SPECIALIST-CONSULTANT FOR ELEMENTARY SCHOOL TEACHERS

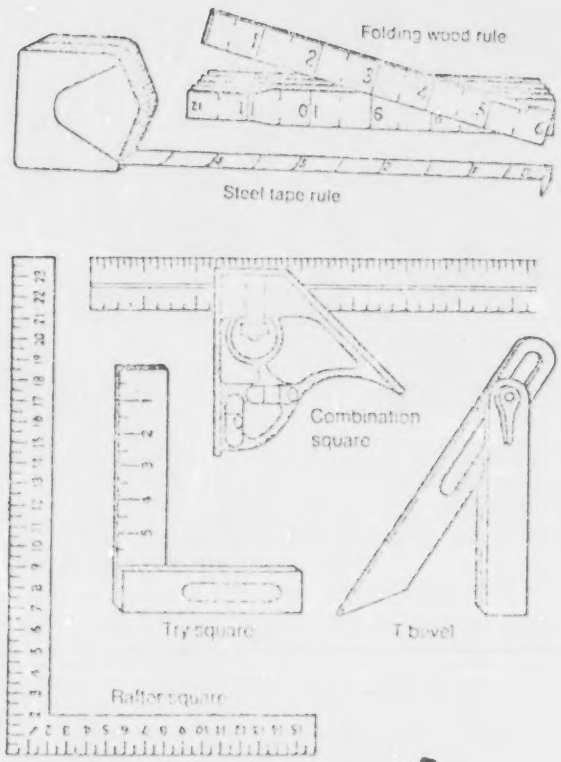
Measuring Tools

There are several different tools used to measure in woodworking. The common ones will be used here. Remember when using these tools that your imagination and common sense should come into play.

The first tool to be considered here will be the folding wood rule. This is used for general measuring especially where rigidity is needed. Next we have the steel tape rule which is also used for general measuring. The tape has the advantage of being able to bend and lends itself to curves and corners. The square and sliding T-bevel are also important measuring tools. The try square is used to mark for right angle cuts and check the squareness of surfaces. The combination square is used for these purposes and also miter cuts. The framing or rafter square is used mainly for large work and by carpenters.

The sliding T-bevel is used to measure an angle and then transfer it to another surface.

The best method for learning these tools is to use them. After identifying the tools in the picture below obtain them and use them to measure objects in the area around you. Remember the CARPENTER'S RULE "Measure twice-cut once".



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PLANES

Planes are used primarily for truing edges of boards. The type of operation required will determine the type of plane used. There are two basic categories of planes; bench planes and block planes. Bench planes are much larger than block planes and are generally used to true edges of boards or to smooth the surface of them. Block planes are used primarily for planing end grain, short pieces, or pieces that can't be put in a vise.

When working with planes, the following procedure will usually give the best results:

1. Layout a line along the edge to be planed.
2. Secure wood in a vise (when applicable).
3. Always plane with the grain using smooth even strokes.
4. When planing end grain, plane half-way across and then switch directions planing towards the middle of the board, this will keep the end grain from splitting.
5. Never plane below the layout mark. When you are close to this mark, a piece of sandpaper will bring the edge down to the mark.
6. NEVER lay a plane down on the blade, the blade is very sharp and this could cause a nick in the blade which will gouge and mar the wood, it will also damage the surface of the bench.
7. To adjust the plane turn the knurled knob until the blade is at the desired height. (This can be checked by turning the plane over and eyeing the tip of the blade with the bottom of the plane.) The more material to come off the deeper the cut can be. A few strokes can indicate whether the plane is adjusted correctly.

SURFORMS

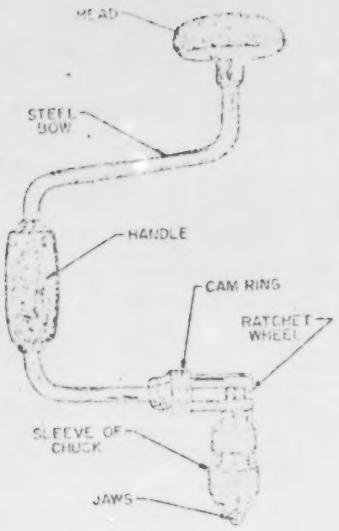
The surform is a cutting tool with a hardened, tempered blade. It never needs sharpening or adjusting. It can be used for cutting, shaping, shaving, smoothing, filing, rasping, and forming. It is easy to cut wood, plastic, and other soft materials. Surforms are available in different shapes that fit most job requirements. Best results can be obtained when light, even pressure is applied to the material. When the blade becomes dull, a replacement blade can be easily changed.

This is a good tool for repairing edges or ends of wood that have split or splintered. This tool is hand held and is used like a plane or file, depending on the type of surform.

CHISELS

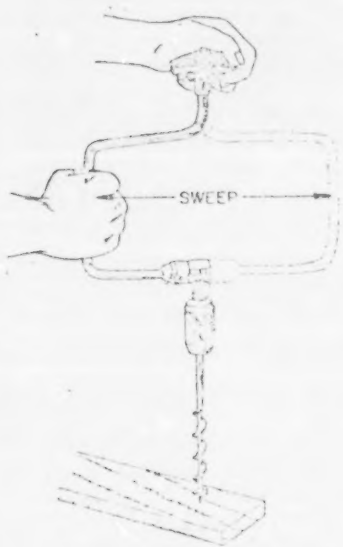
Chisels are hardened, tempered steel tools with a sharp edge at the tip of the blade. They have many uses, but they are dangerous if used incorrectly. Whenever using a chisel make sure eye protection is worn, hold the piece being worked on so it can't move, this can be done by attaching the piece of wood to a vise or to a bench using a c-clamp, keep both hands behind the cutting edge; if the tool slips it will not cut anyone. One hand should hold the handle while the other hand guides the blade, if using a hammer to hit the chisel, make sure to hit the handle squarely on top. Never use a metal hammer on the handle, use a wooden mallet or a leather one.

Chisels can be used to make joints, shape a piece of wood, shave small amounts of material from a piece of stock and many other uses. Never cut against the grain because the wood will split.



The parts of a bit brace.

A bit brace is a tool used to hold the bit to cut larger holes, Fig. 10-15. The holes are usually larger than ¼", so it is most often referred to as boring. The size of a brace is determined by the sweep of the handle, Fig. 10-16. The sweep is the diameter of the circle made when the handle is revolved one complete turn. The sweep provides the mechanical advantage or leverage for turning the bit. Braces are available ranging in size from 6" to 16". A 10" brace is common for general use. Most braces are equipped with a ratchet device to make it possible to turn the bit without making complete turns of the handle. This is an advantage when holes are being drilled in small pieces and accurate depth cuts are being made.



The size of the brace is determined by its sweep as it is revolved one turn.

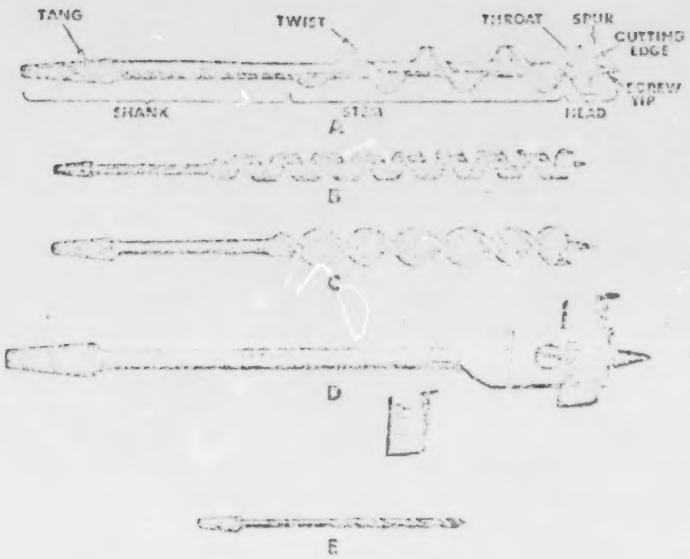
The brace chuck has two jaws which grip the tang of the bit as it is tightened. The chuck is tightened by turning the handle clockwise.

CUTTING HOLES WITH AN AUGER BIT

There are several types of auger bits which are used in the bit brace, Fig. 10-17. The tang fits into the chuck. The feed screw pulls the bit into the stock as it turns and centers the hole. The rate of feed is determined by the pitch of the threads on the feed screw. The outside of the hole is scored by the spur (sometimes called nibs) as the bit is pulled into the stock. Chips are then cut by the cutting lips and forced through the throat. The separated chip is removed from the hole by means of the twist.

Auger bits range in size from 3/16" to 2". Standard sets usually consist of sizes ranging from ¼" to 1" by 1/16" increments. The size of the bit is stamped on the tang, and is given as a number such as a 7. This would mean that the bit would cut a hole with a diameter of 7/16"; a number 8 would cut a hole of 8/16" or ½"; etc. Standard auger bits are from 7" to 10" in length.

The layout for locating a hole for boring with the bit and brace is the same as described for hand drills. The stock to be bored should be secured in a vise or clamped to the bench. A piece of scrap stock is clamped behind the stock to provide support to prevent chipping on the back side as the bit cuts through. The feed screw will also enter the scrap stock and continue to pull the bit completely through the stock.



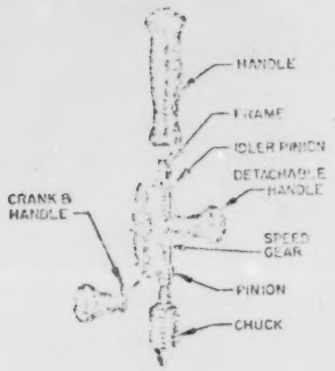
Auger bits are used for boring holes with the bit brace. The most commonly used sets of auger bits range in size from ¼ to 1 inch in diameter by $\frac{1}{16}$ inch increments. Sizes from $\frac{3}{16}$ to 2 inches are also available. The number stamped on the shank indicates the size in sixteenths of an inch. For example, a number 6 bit is $\frac{6}{16}$ or $\frac{3}{8}$ inch in diameter.

The *screw point* centers the bit and pulls it into the work. Screw points have slow, medium, or fast threads. The *spurs* outline the cut and sever the wood fibers in advance of the *cutters*. The cutters lift the chips and start them through the *throat*. The *twist* serves to elevate the wood chips from the hole, thus preventing clogging. Modern auger bits are made in three different styles.

1. The *solid center*. Shorter bits of this type (Fig. 21–32 a.) are called *dowel-auger bits*. They are primarily used to bore holes for dowels.
2. The *single twist* (Fig. 21–32 b.) is used for deep holes. The chips move freely through the center without clogging. The single-twist types are widely used by electricians, ship builders, plumbers, pipe fitters, bridge and dock workers, and other general construction workers.
3. The *double twist* (Fig. 21–32 c) is sometimes referred to as the cabinet-maker's bit. It provides excellent chip elevation on both sides.

The **expansive bit** (Fig. 21–32 d) is an adjustable bit used in the brace to bore holes in sizes ranging from ⅞ to 3 in. in diameter. The bit is set for the desired size by moving the adjustable cutter until the distance from the spur to the screw point equals the radius of the hole. Many carpenters have replaced this bit with hole saws used in power drills.

Brace drill. Bits of this type (Fig. 21–32 e) are also called twist bits. They are twist drills with square tangs. Sizes range from $\frac{1}{16}$- to 1-in. diameters. Variations of this bit in longer lengths are called *bellhanger's* or *electrician's bits*. These are used for boring through walls and beams for telephone and wiring installations and for other deep boring operations.



Basic parts of a hand drill.

A hand drill or automatic drill is used to cut holes less than ¼" in diameter, Fig. 10-5. The drill bit is held in the chuck. The size of the hand drill is determined according to the chuck capacity of either ¼" or ⅜". The ¼" size is the most common. Hand drills are equipped with a three-jaw chuck designed for use with twist drill bits.

The drill bit is tightened in the chuck by holding the chuck and turning the handle clockwise. The chuck will center the drill between the three jaws. The stock to be drilled should be clamped in a vise or secured to a bench. A piece of scrap stock is clamped to the back of the board if the hole is drilled completely through to prevent the stock from splitting, Fig. 10-7.

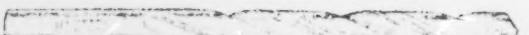
The hole should be carefully located with the proper layout tools. The exact location for the hole should then be started with a scratch awl, Fig. 10-8, to insure exact location of the hole.

The hand drill is held by the handle and the crank is turned. Care must be taken to keep the bit perpendicular to the surface of the stock, as shown in Fig. 10-9.

Slight pressure is applied to the handle as the crank is turned. To remove the bit, continue turning the crank and withdraw it slowly. When deep holes are drilled, it may be necessary to withdraw the drill and clean the chips several times.

It is often necessary to drill numerous holes to a uniform depth. A depth gauge is helpful for this operation. A piece of wood or dowel rod can be used as a depth gauge. A piece of stock is cut to the desired length and a hole is drilled in the center through the length of the stock. The drill projects through the stock the depth of the desired hole, Fig. 10-10. The bit can be moved in and out of the drill chuck to make slight adjustments.

A piece of masking tape will also serve to indicate the depth of the drill to drill holes, Fig. 10-11. However, tape serves only as an indicator, not a stop. The tape is wrapped around the bit the desired distance from the end of the bit.



A twist bit.

Twist bits are available in sizes ranging from 1/16" to ¼" and increase in size by increments of 1/64".

WOOD SCREWS

COMPOSITION OR DESCRIPTION

Screws are made of steel (either galvanized or plated), brass, copper, bronze, cadmium, aluminum, monel, stainless steel.

PROPERTIES

Screws made of steel and cadmium are strong and brittle. Those made of brass, copper, and aluminum are not as strong, but have better resistance to corrosion. Those made of monel or stainless steel are high-strength, special-purpose screws. A screw taps its own internal thread when being driven into wood.

USES

Screws are used to fasten by being turned into or through a piece of material when greater strength than a nailed joint is desired. Screws permit pieces to be taken apart without injury to either member.

SIZES

Screws range in lengths from $\frac{1}{4}$" to 6" and in wire gauges from 0 to 24. The larger the gauge number, the larger the diameter of the wire.

SALES UNITS

Screws may be bought in any desired quantity, but the economical way to purchase them is by the box, containing one gross in lengths under 4" and one-half gross in lengths over 4". However, a recent system of packaging has 100 screws to the box. Handy assortments may be purchased.

CLASSIFICATION

Fastening

PROCEDURE

1. Select the proper size, type, and quantity of screws for the job. Keep in mind that wherever possible, two-thirds of the length of the screw should be in the second piece and that the diameter should be large enough to withstand the probable strain. Oval-head or round-head screws are usually used where the head of the screw will show.

2. Locate the screws not closer than one-half inch from the end of board if possible. Arrange in straight line for appearance and stagger for strength.

3. Drill holes in the first piece the size of the shank or smooth part of screw. These are called shank holes. Counter sink for flat- and oval-head screws.

4. When fastening hard materials- such as maple, oak, birch, or walnut - pilot holes should be drilled in the second piece. These holes may be located by holding the pieces in position and marking through the holes in the first piece with an awl.

5. Drill holes in second piece the size of the root diameter of the screw. This is called the pilot hole.

6. Select screwdriver with a blade tip as wide as the diameter of the screw head and one that fits the slot snugly.

7. Secure pieces to be fastened and place screw in holes. Drive by turning screw in clockwise direction until the two pieces are held firmly in place and the head is seated. Soap or wax may be applied to the screw threads as a lubricant for easier driving.

SAFETY CONSIDERATIONS

1. Be careful screwdriver doesn't slip and cut the hand.

2. Don't rub fingers over the head of screw as small slivers are sometimes raised on the head screw by the screwdriver.

3. See topic on safety.

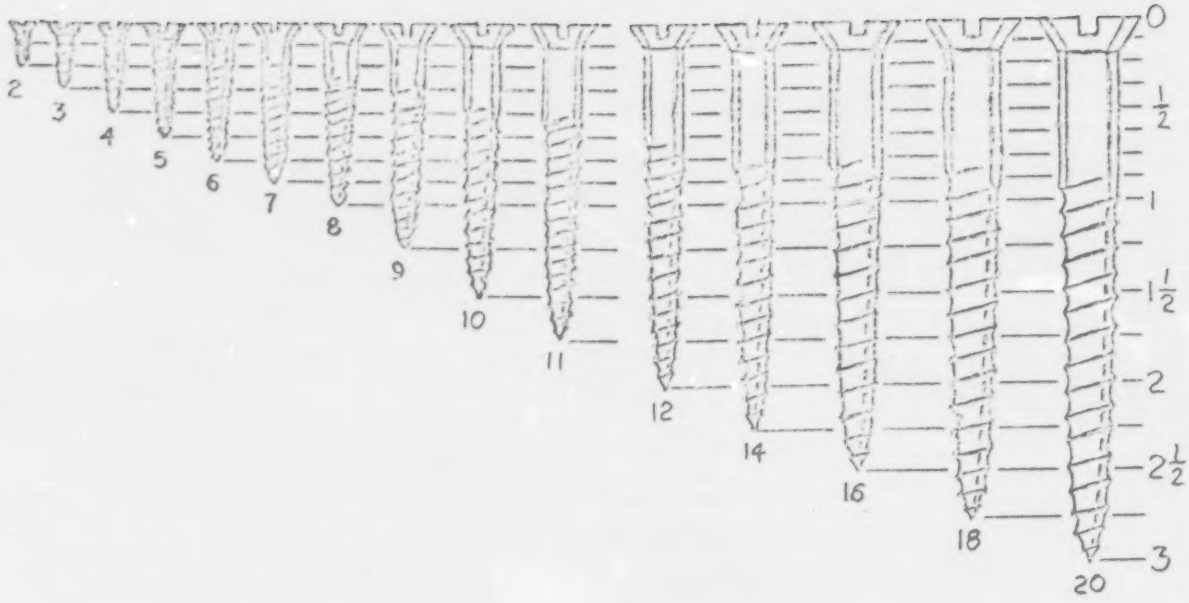


CHART OF COMMON SCREW SIZES. SCREWS ARE ALSO AVAILABLE IN GAUGES 22 AND 24, WITH LENGTHS FROM 4½ TO 6", BUT THESE ARE NOT COMMON.

HEAVY SCREWS AND BOLTS

Heavy screws and bolts are used to fasten wooden members together, side grain to side grain. Since they are available in such a wide variety of sizes, there is no limit to the parts that can be assembled. All standard bolts, nuts, and screws for metal assembly can be used. Some of the most common are:

LAG SCREWS: Similar to wood screws, but larger in diameter, longer, and with a square head. They range in size from 3/16" to 1 ½" in diameter and from 1" to 16" long. They are used in places where the presence of a nut on the surface would be objectionable. The lead hole for the shank of the lag screw should be of the same diameter as the shank and should have the same depth as the unthreaded shank. The pilot hole should have a diameter equal to 60 to 75 per cent of the thread diameter. Install the lag screw with a wrench.

CARRIAGE BOLTS: Used in framing and in fastening metal and wood parts together. They have a crown head and a short, square section under the head which keeps the bolt from turning when the nut is tightened. They are made of galvanized steel, bronze, and monel metal. Carriage bolts are used with washers and the correct size nut.

STOVE BOLTS: Made with a threaded shank with round or flat heads. Square nuts come with the bolts.

MACHINE BOLTS: Made with square or hexagon heads. They are available in a wide range of shank diameters and lengths. Square or hexagon head nuts are also available.

USING BOLTS

The strength of wood parts connected with bolts is determined to a large degree by the size and type of the bolt hole. The hole should be smooth and just large enough so that the bolt will slip in under slight pressure or with a light tap of the mallet. If the hole is too small, driving it in may split the wood. If the hole is too large, the assembly will be loose.

D.R.

HAMMERS AND NAILS

The two most common types of hammers are the claw and ball-peen. The ball-peen hammer can be used to drive nails. It also has a metal ball opposite the hammer head which can be used for shaping metal. The claw hammer is used to drive nails and also remove nails. Claw hammers are ordered according to the weight of the metal head. For general purposes, 12 or 13 ounce hammers are best. Lighter hammers cannot be used successfully by children, because they do not have the weight necessary to drive nails. HAMMER HEADS SHOULD NEVER BE LOOSE ON THE HANDLE! Metal hammers with leather, cork, or rubber grips are excellent. When using a hammer, grip the handle at the farthest point from the head. Greater leverage can be obtained this way.

Nails are measured in units called 'pennys'. Penny is often abbreviated with the lower case ''d'' referring to the length and diameter of the nail. The smallest nail is the ''2d'' or two penny. It is one inch long. As nails increase in penny size, the length of the nail increases by one-quarter inch. Nails smaller than one inch are brads and small wire nails. Nails are sold by the pound regardless of the size. Most nails are made of mild steel, although some are zinc coated to keep from rust.

'' Nail Sets '' are used when it is desirable to drive the nail head below the surface of the wood. The nails should only be driven about 1/16 of an inch. The remaining hole can be filled with putty.

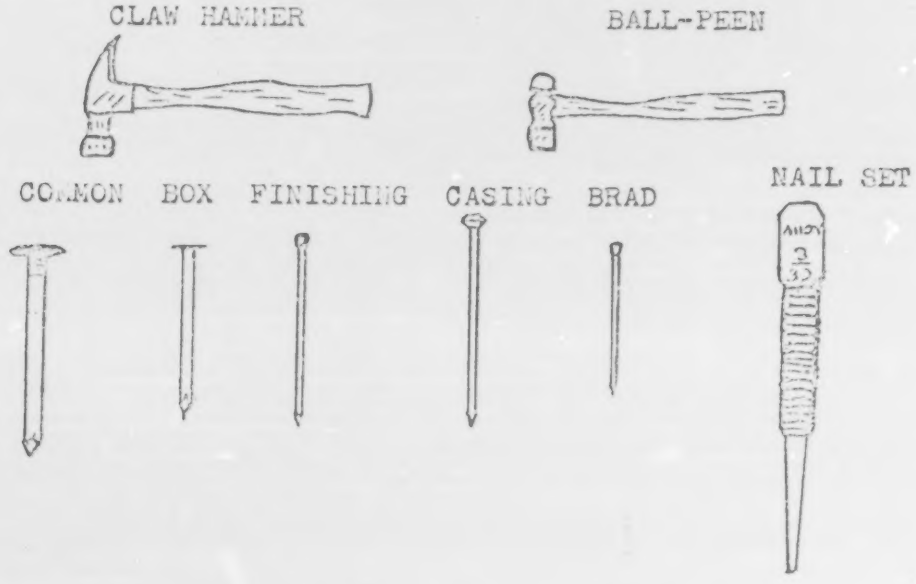


fig 8-5

fig 8-6

Crosscut saw teeth are shaped like a row of sharply pointed knives (Figs. 8-5 and 8-6). The front face of a crosscut tooth makes an angle of 15 deg. with a line perpendicular to the line of the teeth. The back of the tooth makes a 45-deg. angle with this line, as shown in Figure 5. The cutting edge of the tooth is usually filed to a 24-deg. bevel. The cutting action begins with a series of slicing cuts (like knives) which sever the grain fibers on each side of the kerf (Fig. 8-6).

fig 8-3

fig 8-4

Rip-saw teeth resemble a series of small chisels (Figs. 8-3 and 8-4). The front of a rip-saw tooth makes an angle of 8 deg. with a line perpendicular to the line of the teeth. The back makes an angle of 52 deg. Note that the total included angle of a crosscut and rip tooth are both 60 deg. The cutting edges of rip saw teeth are square instead of beveled. This produces a cutting action (Fig. 4) like that of many small chisels.

fig 8-4

The crosscut and the rip saw (Fig. 8-1) are the two most commonly used hand saws. Crosscut saws are designed to cut across the grain, and rip saws are for cutting with the grain. Both cut on the push stroke. A fundamental understanding of the nomenclature and cutting principles of the crosscut and the rip saw may be applied to all hand saws.

The blade of a good crosscut or rip hand saw is taper ground. It is thinnest at the back edge of the point, and gradually becomes thicker as it approaches the handle; the tooth edge is of uniform thickness along the full blade length (Fig. 8-1). The tapered blade provides clearance and free movement in the kerf. The length of a blade is measured from the point to the butt along the cutting edge. Crosscut saw blades are made 20, 22, 24, or 26 in. in length. Rip saws usually have 26-in. blades.

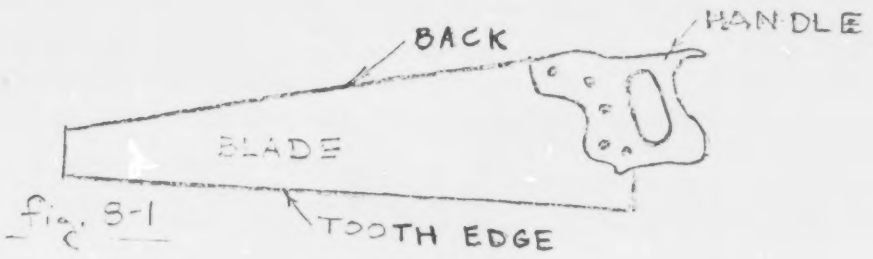


Fig. 8-1

Points to the inch (Fig. 8-2) is a term used to designate the size of teeth on a saw. The number of teeth per inch is one less than the number of points per inch. Saws with a greater number of points per inch make smoother cuts, but they cut more slowly than those with fewer points. Generally, crosscut saws have 8 to 12 points per inch and rip saws have 5½ or 6 points per inch.

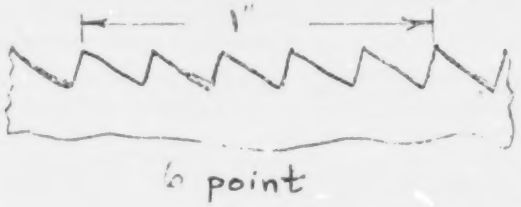


Fig. 8-2

The set of a saw is the alternate, outward bending of the teeth to make them cut a "kerf" wider than the thickness of the saw blade (Figs. 8-6 and 8-4). The amount of set is determined by the nature and character of the wood to be cut. Green (wet) wood requires more set and coarser teeth than dry wood. Softwoods require more set and coarser teeth than hardwoods. Generally, the amount of set for a rip saw is about one third of the thickness of the blade. Crosscut teeth are set to about one fourth of the thickness of the blade.

The back saw (Fig. 8-7) has fine crosscut teeth, 12 to 16 points per inch, and a thin blade supported by a stiff back which gives this saw its name. Lengths range from 12 to 20 in. The back saw is used for fine, accurate work in finish carpentry, cabinet, furniture, and patternmaking. Larger sized back saws are often used in a miter box as shown in Figure 8-8.

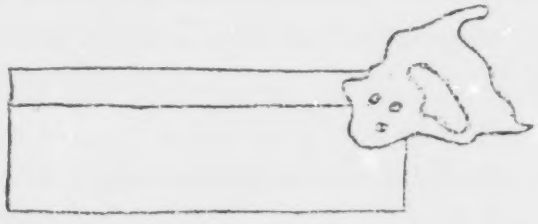


fig 8-7

The miter box (Fig. 8-8) is a device used to hold the work while it is cut at an angle. It is widely used by cabinet and finish carpenters and other skilled craftsmen in custom manufacturing. The back and base frame are usually constructed of cast iron. Most types are equipped with automatic catches which hold the saw in an elevated position (Fig. 8-8) so that both hands may be used to place the work. Adjustable stops are used to cut duplicate pieces to length and to a specific depth. The saw may be swiveled up to 50 deg. right or left. Automatic locking positions are usually provided at 0, 9, 22½, 30, and 45 deg. to the right and left.

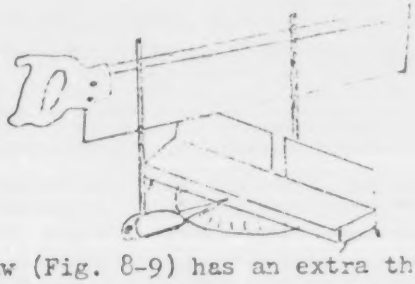


fig 8-8

The dovetail saw (Fig. 8-9) has an extra thin tapered blade (about .032 in. or less), thinnest at the supported back. It is similar to, but narrower than the back saw, has fine teeth (15 to 20 points), usually no set, and a round handle. This saw is designed for very accurate cutting of joints such as the dovetail and tenon. Today, it is primarily used in patternmaking and model construction where smooth sawing of light-weight material is required.

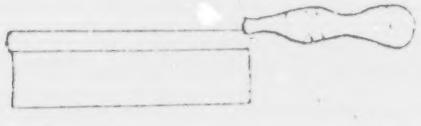


fig. 8-9

The compass saw (Fig. 8-10) has relatively coarse (8 to 10 points) saw teeth. It is characterized by a pointed blade which may be inserted into a bored hole for making a cut that will permit the insertion of a crosscut or rip saw. The point may be forced through wallboard to make cutouts for receptacles.

fig 8.10

The keyhole saw (Fig. 8-11) is similar to the compass saw, but the blade is narrower. It has 10 points to the inch. This saw is used for cutting frets and other inside designs. The saw is started in a hole that is first bored in the work.

fig 8.11

The nest of saws (Fig. 8-12) is used for cutting a variety of materials. The open-grip, wooden handle will hold any of 3 interchangeable blades. The plumber's (metal cutting), compass, and keyhole saw blades are most commonly furnished.

fig 8-12

The coping saw (Fig. 8-13) is sometimes referred to as a hand scroll saw. The blades have either loop or pin ends and 15 points per inch. Spiral cutting blades are available. The steel frame is usually nickel-plated. The blade may be inserted to cut on either the push or pull stroke. It is tensioned by turning the handle, and it may be rotated 360 deg. The narrow blade permits this saw to cut sharp curves and make inside cuts. This saw is also used for cutting fine fretwork or scrolls. Carpenters use this saw to shape the end of a piece of molding to fit the face at inside corners in what is called a coped joint.

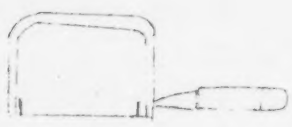


fig 8-13

Some Suggestions for Sawing

1. Lay out the line of cut on the work with a sharp pencil or a knife.
2. Clamp or hold the work securely. Support large workpieces on saw horses. Smaller sized work may be held more conveniently in a vise. When sawing irregular curves with a coping saw, hold the work in a vise or on a saddle.
3. Hold the saw handle with the forefinger extended along the side of the blade. Use your free hand to support the work or the saw as necessary.
4. Place the saw on the edge of the work on the waste side of the line to be cut.
5. Start the cut with a backward stroke. Use your thumb as a guide to steady the blade. Keep the saw, your forearm, and your shoulder in line with the layout line.
6. Use just enough pressure to keep the saw cutting. Relieve the pressure on the back stroke.
7. Saw with long, steady strokes.
8. When crosscutting lumber, hold the saw so the tooth edge makes a 45-deg. angle with the work. For ripping, a 60-deg. angle is best.
9. If internal stresses in the lumber cause the board to pinch the saw, insert a wooden wedge into the kerf to keep it open.
10. When sawing prefinished paneling or plywood with one good side, keep the good side up.
11. When sawing any type of plywood, use a crosscut saw and a cutting angle of 20 to 30 deg. This practice will reduce the tendency for the bottom face veneer to splinter on the downward stroke.

Some Suggestions for Sawing (continued)

12. If the saw starts to drift away from the line of cut, twist the handle slightly on the cutting storke to bring it back to the line of cut.

13. When sawing an irregular outline with a coping saw, hold the blade at 90 deg. to the surface of the work. This will help to produce a sawed edge that is at right angles to the face.

14. To make piercing (inside) cuts, drill or bore a hole within the waste area of the work large enough to insert the blade of a coping saw or the point of a keyhole or compass saw.

15. For greater a-curacy in joint making, use a miter box or a piece of scrap with a straightedge to guide the saw.

16. When finishing a saw cut, support the piece being cut off. If the piece is not supported, it will break off as the cut nears completion and split the underside of the work.

17. Keep saws sharp. Usually it is better to have saws sharpened professionally.

18. When saws are not in use, store them so the teeth do not become damaged. Wipe them with oil to prevent rusting. Lay saws on the bench top carefully so they do not touch other tools or work.

Wood files are utilized in the finishing and roughing of wood to shape and for the smoothing of curves, usually on the edges of boards, after they have been sawed out. Rasps and files are gangs of chisel-like teeth formed on a hardened tool steel surface. Files and rasps are identified by four characteristics:

1. Length:
   a. Measured from the heel to the point (see A)
   b. The most widely used sizes generally range from six to twelve inches.
2. Shape:

   Identification of the geometric cross-sectional shape
3. Cut:

   Shape of the cutting teeth (single, rasp, double)
4. Grade of Coarseness:
   a. Size of the teeth and their spac ing
   b. Courseness is designated as
      1. bastard
      2. double cut
      3. smooth
   c. The longer the file the larger the teeth
   d. An 8" bastard double cut file has finer teeth than a 12" bastard double cut

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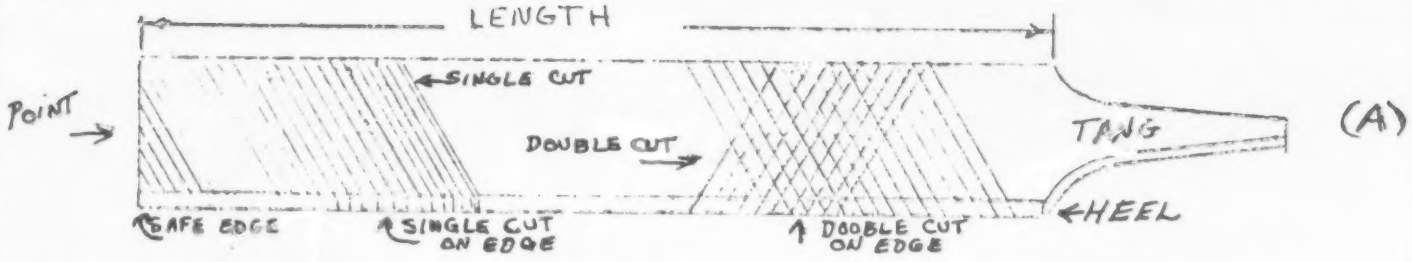
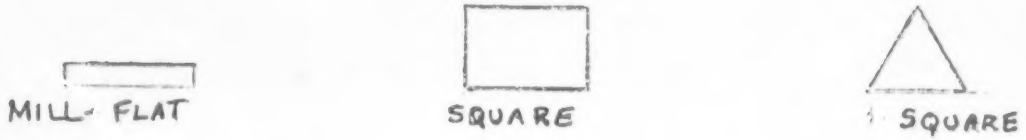


(A)



(B)

MOST COMMON SHAPES

Sanding is the process of employing coated abrasives to smooth wood surfaces by hand or machine. Coated abrasives are composed of paper or cloth backings to which hard crystalline grains are bonded. Coated abrasives consist of abrasive grains, an adhesive, and a backing material. Some types of abrasive grains are:

1. Aluminum oxide - the toughest abrasive which is used to sand hardwoods.
2. Silicon Carbide - is used for finish sanding of lacquers and enamels
3. Garnet - prinicipally used for sanding soft-wood
4. Flint - is low in cost, but wears out easily

The sizes of abrasive grains or grits range from fine to coarse. The smaller the grit size the smoother the surface on which it is used. Silk screens are used to separate the grits into various mesh sizes. For example, a 220 mesh screen has 220 openings to the lineal inch (in each direction.) Grit sizes range from 12 (the coarsest) to 600.

There are five kinds of backings of coated abrasives:

1. Paper - the most common type
2. Cloth - is used for operations that require greater strength and flexibility than paper
3. Paper-Cloth combination - is more resistant to tearing and not as flexible as cloth
4. Fiber - is very stiff and is used for rough work
5. Fiber-Cloth Combination - this has the greatest strength

Each kind of backing has its advantages for certain jobs.

There are various types of adhesives:

1. Hide Glue - is used in dry sanding operations where heat and friction are not severe.
2. Synthetic Resins - these are used in operations that generate intense heat
3. Modified Glue - is waterproof
4. Modified Resins - are used where exceptional grit holding and water and heat resistance are needed

Two types of coating are as follows:

1. Closed Coating - this type has a backing which is completely covered with grit. The adhesive is exposed
2. Open Coating - this type has a backing on which 50 to 70 per cent of the surface is covered with grit. The open surface prevents "loading up" when the abrasive is used on soft or gummy materials.

Sizes of Grits

	Silicon Carbide	Aluminum Oxide and Garnet	Flint
	600	600 (12/0)	
	500	500 (11/0)	
Extra Fine	400	400 (10/0)	
	360		
	320	320 (9/0)	
	280	280 (8/0)	
Very Fine	240	240 (7/0)	5/0
	220	220 (6/0)	4/0
	180	180 (5/0)	3/0
Fine	150	150 (4/0)	2/0
	120	120 (3/0)	1/0
	100	100 (2/0)	½
Medium	80	80 (0)	1
	60	60 (½)	1½
Coarse	50	50 (1)	2
	40	40 (1½)	2½
	36	36 (2)	3
Very Coarse	30	30 (2½)	
	24	24 (3)	
	20	20 (3½)	
Extra Coarse	16	16 (4)	
	12		

THE USE OF TEMPLATES# PATTERNS JIGS AND FIXTURES FOR THE ELEMENTARY SCHOOL

JAMES LUNDELL
I.A. 459

When implementing an industrial arts program in the elementary school, the use of templates, patterns, and jigs and fixtures can be used to help the students and teacher in designing and building specific objects.

When working with young students it is very important and useful to use certain aids and guides to help them produce neat and accurate work. Many times young students lack coordination and fine motor skills.

1. TEMPLATE - Templates are devices that can be made out of cardboard, wood, plexiglass, plywood, or any substance that has a rather hard composition. They are used as guides to cut, drill, plane, or shape material to the size of the template. These templates are made so they can be used over and over again. Templates are usually made as full sized patterns or outlines of a design.
2. PATTERNS - A pattern is similar to a template in that it gives the size and shape of an object. Patterns can be made of thin or light materials such as paper or thin cardboard, so that they can be cut out, folded, or bent into a specific shape. There are three ways to get a pattern: make your own, enlarge a smaller one, or use a full size ready-made pattern. An example of a pattern would be the paper shapes used when making cloth using sewing patterns.
3. JIGS AND FIXTURES - In elementary arts programs, jigs and fixtures can be used by students as guides for locating holes, cutting of, lining up materials and fastening.

A jig can be a simple tool or it can be complicated depending on its use. Basically it lines up and holds materials for specific operations such as drilling or nailing in certain areas. The fixture is used to hold the jig in place, and can act as a guide for the jig.

It is important when finishing a wooden article that it be carefully smoothed down and wetsanded. Wetsanding involves brushing the article down with a small amount of hot water, just enough to make it damp. The fibers of the wood will swell with the damp and after it has dried for a few hours, the raised fibers can be rubbed down with a clean sheet of extra fine sandpaper. You are now ready to apply a stain, glaze, varnish, or oil finish.

Polishing oil is an old and well known method for treating wood. It is simple to do, gives a satin finish, and makes the wood more resistant to dirt and moisture. The oil is applied freely with a linen rag so as to saturate the wood and the wet surface is then rubbed down with Grade 00 glasspaper. It is then wiped clean and another coat of oil is applied. Linseed oil, diluted one to one with turpentine, provides the most lasting finish. It is important that rags soaked in linseed oil be burned or put in a sealed container to be discarded.

Another method of finishing wood is glazing. Glazing is painting wood with oil color diluted with turpentine to about the consistency of thick cream. At least two coats are needed for a satisfactory result, rubbing down lightly with Grade 00 glass paper as soon as the first coat has dried. Care must be taken to apply only thin coats of glaze so that the texture of the wood will show through when finished.

Staining wood consists of two types, dye stain and chemical stain. In both cases, the wood is painted with a liquid and allowed to dry after which a protective finish of linseed oil or clear varnish is applied.

Clear varnish or polyurethane varnish is unaffected by water or alcohol spirit, is scratch resistant, and does not discolor with exposure to light. Some polyurethane varnishes need a hardener additive and this is usually enclosed with the package. Varnish to which hardener has been added must be used at once.

Varnish is sold as glossy, semi-matt, and matt; the latter two types are recommended. It should be diluted slightly before being painted on with a good quality brush and immediately brushed out evenly. As the varnish dries very quickly, any going back to touch up can spoil the surface. The can will usually give a complete description and detailed instruction for use.

Wood is formed of cells that are thin, pliable tubes that act as pipes to obtain nourishment and water from the soil. The walls of these cells vary in thickness from species to species, and it is the degree of this characteristic which establishes the porosity of wood.

It is by the growth of these cells that new layers of wood are added to the tree each year. The speed of the growth, which is most rapid in the spring, can result in different degrees of hardness and color. When you examine the cut end of a log you can see concentric circles which are actually the annual growth rings. By counting them you can determine how many years the tree has taken to get to this point.

Trees have been placed into two categories - hardwood and softwood. The designation does not actually indicate the degree of hardness or softness. Hardness of hardwood trees come from broad leaf, deciduous trees; softwood is from cone bearing or evergreen trees. Fir is a softwood but it is actually anything but soft.

Mahogany: History tells us that Sir Walter Raleigh brought mahogany back to England because he used it to replace some ship's timber. It was made into furniture at the request of the Queen and has been used ever since. It has wide appeal and is used in lumber form or veneers. It can become more mellow and beautiful with age, is fine for carving, resists warping and works easily with machine or hand tools.

Maple is strong, hard, and dense and despite the fact that it can dull tools faster than many other woods, it is very popular with furniture makers.

Cherry wood is peculiar in that it turns cherry red when exposed to light. Antique collectors are apt to judge the age of cherry furniture by its color. Few woods endure the ravages of time and use.

Oak is a very tough wood, a fact appreciated by craftsmen of yesteryear who used it to make oxen yokes, wagon wheels and wooden frames.

Walnut is one of the finest cabinet and furniture woods available. Walnut has pleasing grain variations and possesses beauty that should emphasized with a natural finish. A good oil finish does it justice.

Pine wood is usually soft textured and easy to work with machines. You can buy it knotty or clear and it can be finished in different ways.

There are many other woods such as fir, redwood, cypress, spruce, hemlock, ash, willow, chestnut, beech, and elm. One good way to get a look at all the woods is to acquire a set of samples. Two sources are listed below, but do not just send away requesting samples; they cost money!

Constantine's Wood Catalog and Manual
Albert Constantine and Son, Inc.
2050 Eastchester Road
Bronx, N. Y.

Craftsman Wood Service Company
2727 S. Mary Street
Chicago, Illinois

GLUES

Gluing operations may involve the use of a number of different kinds of adhesive material. The term "adhesive" is defined as a substance that is capable of holding objects together by surface attachment. It is a general term that includes glue, paste, cement, and mucilage.

Kinds of Glues

Polyvinyl Resin Emulsion Glue (generally called polyvinyl or white glue) is excellent for interior construction. It is not waterproof and should not be used in assemblies that will be subjected to high humidities or moisture. Therefore, it should not be used in the construction of such articles as radios or TV cabinets where the temperature may rise above 165 degrees. Polyvinyl glue has a corrosive effect on iron and steel and should never be allowed to remain on the metal surfaces of tools.

Urea-Formaldehyde Resin Glue (usually called urea resin) is available in a dry power form which contains the hardening agent, or catalyst. Urea resin is moisture resistant, and sets at room temperatures in from 4 to 8 hours. This kind of glue is often used for gluing plywood which is bonded in hot presses (240-260 degrees) in from 3 to 5 minutes. Urea resin is also available in liquid form. Powered urea resin is a good glue to use for cutting boards, salad bowls, and other articles that may be subjected to moisture for a short period of time.

Resorcinol-Formaldehyde Resin Glue (called resorcinol glue) is available only in a two part form; a dark reddish liquid resin, and a powered or liquid hardener or catalyst. It is strong, durable, and waterproof. It sets up at room temperatures in 8 to 10 hours. This glue is well suited for water skis, boats, and other structures that will be exposed for long periods to high humidities or water.

Epoxy Resin Glue is a relatively new adhesive that is so strong it takes the place of rivets in many aircrafts assemblies. Epoxy comes in two components; a white epoxy resin and a catalyst. In woodworking, it is ideal to use for attaching a metal or some other nonwood fitting to a wood surface or assembly.

Contact Cement comes in the form of a light tan liquid. It is made with a neoprene rubber base. It is excellent adhesive for applying plastic laminates or joining parts that cannot be clamped together easily. It can be used to join any combinations of wood, cloth, leather, rubber, plastics, thin sheet metal.

Casein Glue is classified as a water resistant glue. Casein glue is used for interior structural laminating and works well where the moisture content of the wood is high. Casein is used for gluing oily woods like teak, padouk, and lemon wood. Its main disadvantages are that it stains the wood, especially such species as oak, maple, and redwood, and has an abrasive effect on tool edges.

Animal Glue (also called hide glue) is made form hides, tenons, and bones of cattle. It is still available today but not widely used. Animal glue is sold in sheets, flakes, pearl and ground forms. Animal glue is also available in liquid form and is packaged in plastic squeeze bottles. This form holds wood parts securely and is easy to handle. It is not waterproof.

Plastic Cement (often called airplane cement). It is used for household repairs and is excellent glue for model building. It sets up fast so it can be handled in about 10 minutes.

Rubber Cement is valuable for the woodworker in gluing paper and cardboard patterns. Since there is no moisture present, the material remains wrinkle free.

CLAMPING DEVICES

Kinds Of Clamps

The clamps most used in woodworking and furniture making are the cabinet, or bar, the hand-screw, and the C clamps. Each type works by a hand-screw adjustment, and each has a particular use.

Bar Clamps are available in various lengths (maximum opening) from 2 to 8 Ft. When tightened firmly with one hand they will exert about 600 lbs. of pressure. When tightened with both hands on the crank you can apply pressure of well over 1200 lbs. Manufactures of adhesives generally recommend 100 to 150 psi for soft wood and 150 to 200 psi (pounds per square inch) for hard wood.

Hand Screws are ideal clamps for woodwok because the jaws are broad and distribute the pressure over a wide area. The greatest pressure can be attained by tightening the outside or "end" spindle as it provides greater leverage than the "middle" spindle. Hand screws are available in sizes (total length of jaws) from 4 to 24 in. Sizes most commonly used in school shop are 4, 6, 8, and 12 inches.

C-Clamps provide a compact clamping device and are sometimes helpful in gluing operations. In woodworking they are often used to clamp parts to machines and make special setups. They are available in sizes (largest opening) from 1 in. to 12 in. with the smaller sizes of 2, 3, and 4 in. most being used in woodwork.

HARDWARE

Some of the more common pieces of hardware for the woodworkers are hinges, drawer pulls, cabinet catches and hasps, locks, and furniture glides.

Hinges

The butt hinge is popular. It requires detailed fitting and gaining (chiseling out) of the cabinet or frames. Some butt hinges are swaged, while others are not. This will determine the depth of the gain. You can obtain butt hinges with loose or with stationary pins. If the pin is loose, install the hinge with the head of the pin up.

The surface hinge is one of the easiest to install. It is fastened to the surface and is entirely visible. Its patterns vary from ornate shapes to the crude metal strap used on barn doors.

The half-surface hinge is used in cabinetmaking. It is installed so that half of it is visible. The other half is gained to the cabinet or into the frame in which it is fitted. The gained portion is fitted like the butt hinge.

The chest hinge supports chest lids.

The combination hinge may also be used along with the chest hinge. The hinge pulls the lid away from the walls as it is opened. It serves as both hinge and lid support.

Cabinet hinges are made for use on flush doors and on overlapping doors.

Invisible hinges are used in fine furniture, such as writing desks. Manufacturers supply the drawings and directions for the installation of this type of hinge.

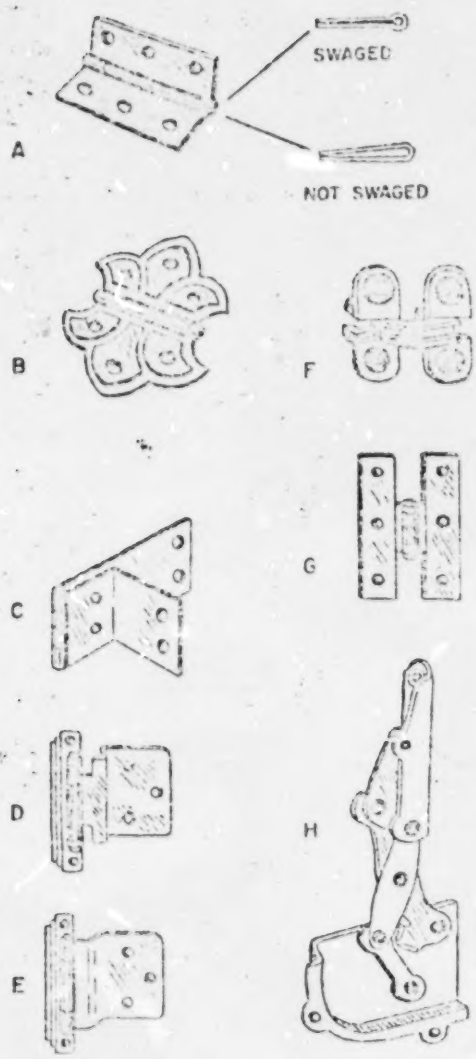
Drawer Pulls And Knobs

Drawer pulls and knobs come in a great variety of materials, patterns, and sizes. They are made of wood, plastic, composition, and metals. You are limited only by your personal perference. On the back page there are various types of hinges along with four typical commercial drawer pulls and knobs. They are supplied complete with screws for

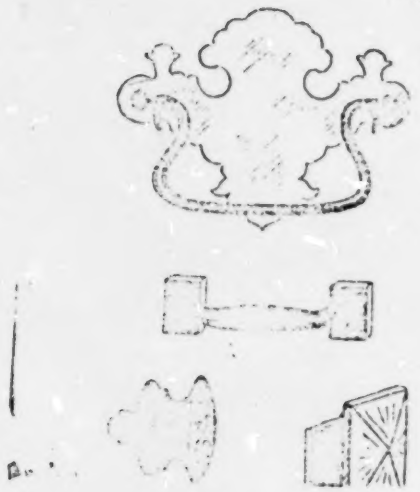
fastening. The single-post, or screw, knobs are easy to install. Mark the location and drill a hole of the proper size. More elaborate pulls and knobs have two posts or screws. These holes must be properly centered for correct fit.

Other Hardware

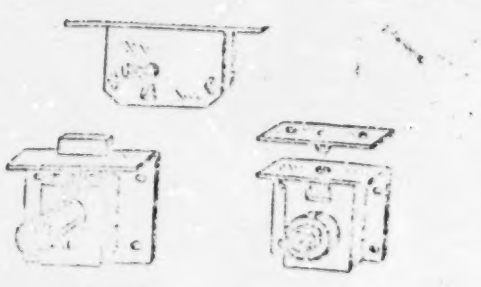
Hasps, door and friction catches and furniture glides are some other types of hardware that are relatively easy to install. For sucessful installation of the cabinet and chest locks just follow the manufacturer's directions. The variety in sizes and construction of such hardware makes it impractical to outline a uniform procedure for all types.



Commonly used hinges;
(A) butt, (B) embrossed-surface,
(C) chest, (D) cabinet flush,
(E) cabinet overlapping, (F) invisible
(G) antique butt, (H) combination
chest and lid support.



Four common types of drawer pulls and knobs.



Cabinet and Chest Locks.

WORKSHOP - ITEMS TO MAKE

Now that some basic technical knowledge has been acquired, it's time to put it to good use. There is one aspect of teaching which we all unfortunately share - and that's the money shortage. In perusing numerous catalogs, a multitude of creative objects to use with young children has been discovered. Many are outrageously priced. On a more closer look, the relative simplicity of these forms becomes evident. With some skill, and scrap lumber, it is possible to reasonably duplicate some of these objects, at a more palatable price. Rather than attempt to choose a few objects to outline in detail, some general ideas of possible projects are offered, and also names of companies who manufacture these items. A study of one of their clear photographs would be more helpful than explanations and renderings. Catalogs are available at no cost, and are crammed full of ideas. Below are listed some suggestions of possible classroom aids, and also some companies whose catalogs would be helpful.

CLASSROOM AIDS BY CATEGORY

Gross Motor Aids
Balance Beam
Balance Board

Safety
Small Traffic signs

Math
Fraction Pies
Fulcrum Balance
Cuisinnaire Rods
Counters (blocks or dowels)

Fine Motor Aids
Pegboards (use dowels & rings)
Sorting Box (colors, nos.)
Lacing Boards
Size Sequencing Boards
(use various sized nuts and bolts)

Toys
Doll House and Furniture
Boats, Trucks, etc.

EDUCATIONAL MATERIALS COMPANIES

Developmental Learning Materials (D.L.M.)
7440 Natchez Avenue
Niles, IL. 60648

J.L. Hammett Co.
Braintree, MA. 02184

Northern School Supplies & Equipment
Penobscot Brands
Bangor, Maine

Webster Paper & Supply Co., Inc.
30 Colonie Street
Albany, N. Y. 12207

SAMPLE FACILITY LAYOUTS FOR CONDUCTING ELEMENTARY SCHOOL

INDUSTRIAL ARTS ACTIVITIES

Converting Part of a Regular Classroom to an I.A. Center

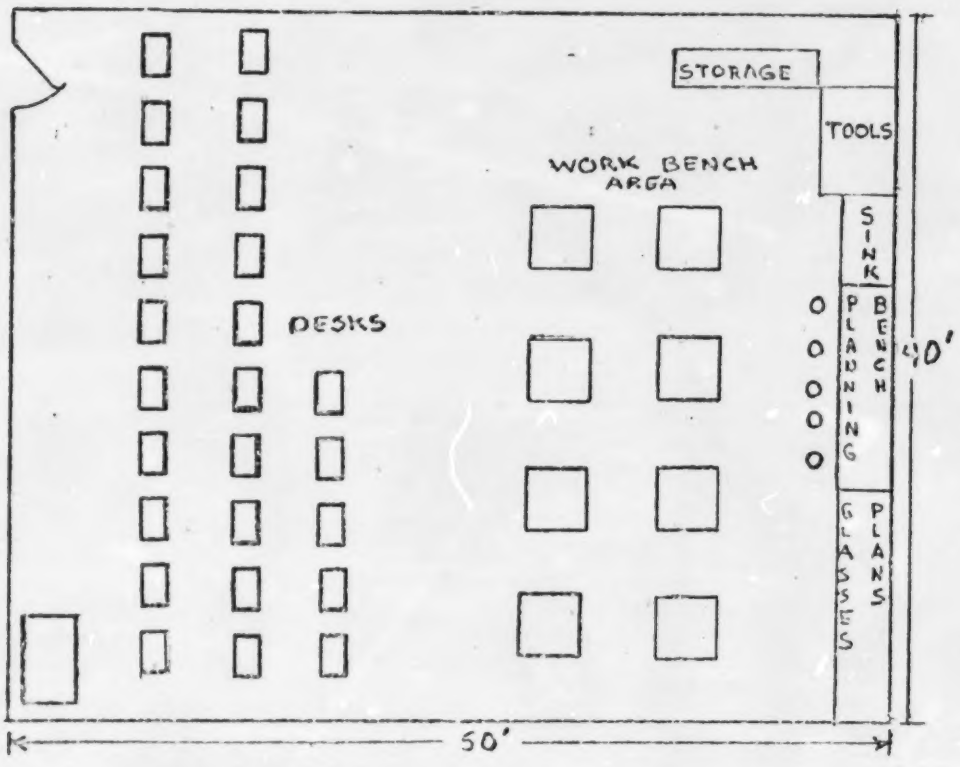
The amount of money the teacher is allotted for I.A. activities plays a big part in what can be afforded. The teacher should limit the facilities to what is needed to carry out a given program.

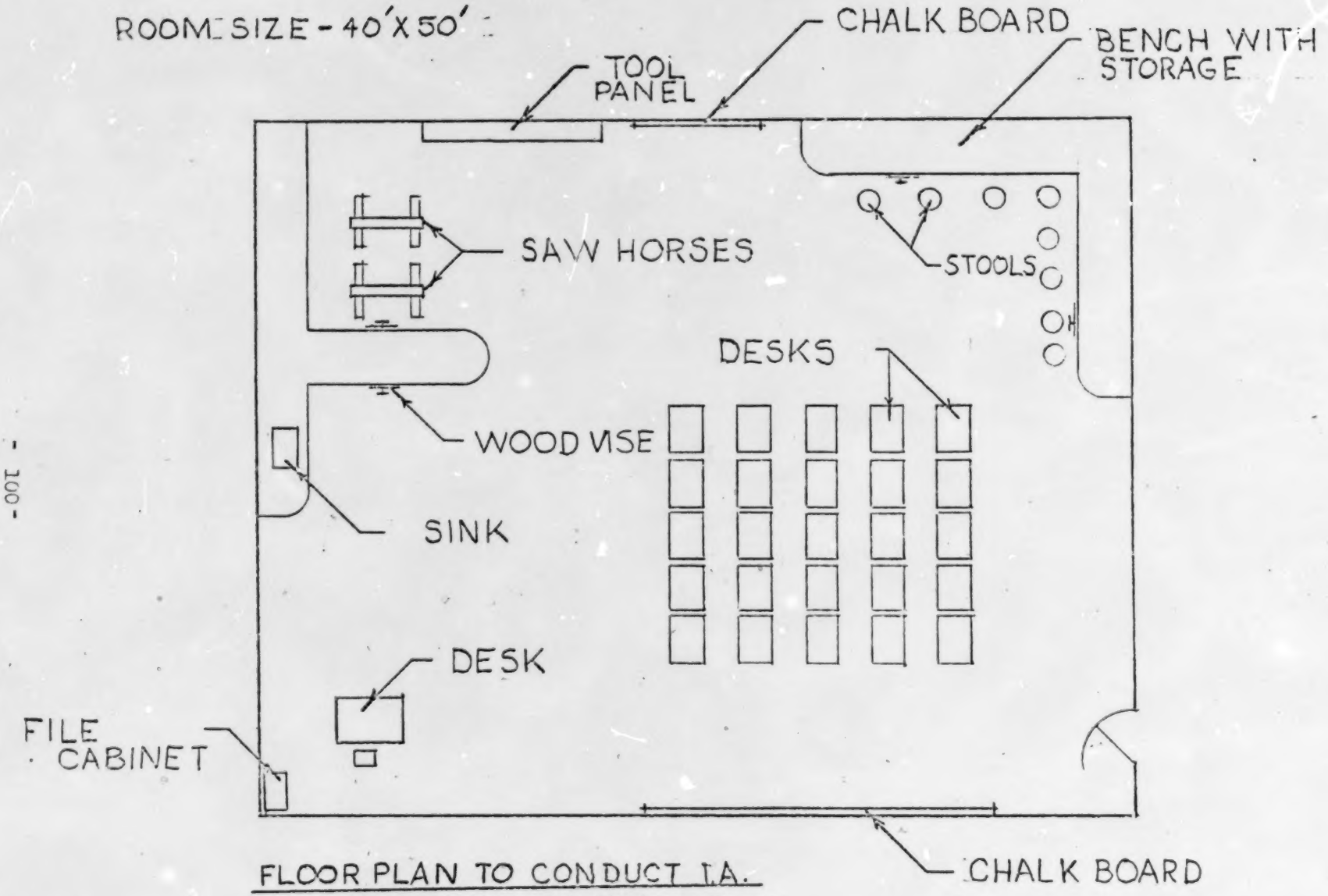
Children utilize most adult hand tools awkwardly, but they get the job done. A workbench should be purchased at 29 inches high instead of the standard 33 inches. Tools should be mounted low enough on the wall to let the smallest children reach what they need. It is easier for a tall student to stoop, than a short student to reach. The use of tool silhouettes will make tool identification and inventory checks easier. A rolling cart can also be used, allowing for portability of tools to different classrooms.

Lumber should be stored in a vertical cabinet rack placed about 12 inches from a wall. This space allows for plywood sheet storage. Space is needed for safety glasses and plans also.

A sink is needed for clean-up, and plenty of ventilation should be provided to exhaust fumes and dust.

Shown in the floor plan are facilities for 25 students. Unless proper guidance is available, it is suggested that I.A. activities be conducted with small portions of the class at a time.





FLOOR PLAN TO CONDUCT I.A. IN THE NORMAL ELEMENTARY SCHOOL

SUGGESTED TOOL LIST

SUGGESTED LIST OF EQUIPMENT FOR INDUSTRIAL ARTS ELEMENTARY CLASSES

Tools may be mounted on a movable cart or room mounted. List based on a student population of twenty students. (Subject to revision to meet individual teaching needs).

2 sets auger bits
4 bit braces
10 C clamps 4"
2 countersinks 3/4"
2 dividers 6"
4 drills, hand
2 sets of twist drills 1/16" to 1/2"
2 file cards
4 flat files w/handles
4 half round cabinet files 10" w/handles
2 round files 10" w/handles
2 three square files 10" w/handles
2 half round cabinet rasps 10" w/handles
4 surforms
4 extra blades for above, flat
4 extra blades for above, half round
4 pocket surforms
4 pocket surform blades
5 hammers - 7oz.
5 hammers - 12oz.
2 nail sets 2/32"
4 block planes
4 smooth planes
2 exacto knifes
1 package needles
1 rubber mallet
4 - 16 oz. containers titebond glue
100 sheets garnet cabinet paper - 80 grit
100 sheets garnet cabinet paper - 120grit
1 pair pliers, combination 6"
1 pair side cutting pliers 6"
6 bench rules 24"
6 bench rules 12"

4 saws, back, 10"
2 saws, compass, 14"
12 saws, coping 6½"
100 extra blades for above
3 saws, hand crosscut 16" 11 point
3 saws, hand crosscut 20" 10 point
4 saws, hand rip 26" 5½point
2 saws, keyhole
8 scissors
3 screw drivers, assorted
4 scratch awls
4 squares, try, 8"
4 combination squares 12"
6 vises, detachable
2 paper punches
10 plastic yarn needles
2 razor knives
2 tin snips
1 wooden mallet
1 miter box
1 set of wooden chisels
10 lbs. 6d box nails
10 lbs. 2d finish nails
10 lbs. 4d finish nails
10 lbs. 6d finish nails
10 lbs. 8d common nails
5 lbs. flathead screws ½"
5 lbs, flathead screws 1"
5 lbs, flathead screws 1½"
12 rolls masking tape
10 cans paint
10 ½" paint brushes
10 1" paint brushes
10 artist brushes
1 assortment poly-brushes
2 adjustable wrenches
1 wire stripper
4 compasses
20 aprons
1 magnetic compass
20 pairs safety glasses

Option electric power tool
1-¼" electric drill

American Council on Industrial Arts Teacher Education.
Industrial Arts for the Elementary School, 23rd Yearbook.
Thrower, Robert G. and [illegible] Robert D., editors, [illegible] Publishing Company, 1974.

This publication is intended to serve both the elementary teacher as well as the industrial arts professional-consultant. The major points that are stressed deal with the source of curriculum content, Industrial Arts in the Elementary School, curriculum design, and the learning environment. In addition, this book also covers what is presently happening in elementary programs as well as the personnel involved, [illegible] historical reflections, philosophical positions, and related research.

This book explains elementary school Industrial Arts functions for the elementary teacher as well as the Industrial Arts professional, stressing that the programs are largely dependent on persons outside the Industrial Arts field.

American Industrial Arts Association, Elementary School Industrial Arts, editor Stamm, Colleen, Washington, D.C., 1973.

This publication is geared toward the Industrial Arts Consultant-Specialist, but it is also appropriate for the elementary school teacher. The major focus of this pamphlet is to provide the teacher with information on why Industrial Arts should be taught in the elementary schools. Panel members attempt to answer this question as they answer the following questions: (1) What is the nature of Industrial Arts? (2) What is the relationship of Industrial Arts to the total elementary school curriculum? (3) What are the benefits of Industrial Arts to the elementary school pupils? (4) What are some of the trends of elementary school Industrial Arts?

This publication provides the reader with five ways of developing elementary school occupational-education programs within the curriculum: (1) Project LOOM is concerned with a basic idea that occupationally related learning materials should be geared toward the learner, not the teacher or the administrators. Also the learner must have the opportunity to learn about himself in relation to the external world by active participation in various jobs and occupations.
(2) Porject LET enables the teacher to provide the students with an environment for active learning. Its content base is designed to provide technological concepts that focus on career awareness and the methodological base consists of the Integrated Teaching Unit which is evolutionary in nature. (3) ABLE Model Program attempts to provide the teacher with a theory of practice. Input and output are to be researched within the basic element which is the decision-making professional teacher. The form that the world of work must take to become effective as an organizing center is discussed as is the importance of the teachers' imagination in studying the "person in the occupation." (4) A Technological Exploritorium, K-6 proposal stresses the total experience rather than projects in the study of technology. To create a more meaningful experience content and method are considered of equal value in getting the student to think from more than one basic point. Students study man, society, and technology by taking abstract thinking and putting it into conceptual statement form.
(5) World of Work, K-6, Elementary Industrial Arts program is essentially a team effort involving a coordinator, the school principal, two teacher chairman, and

the teachers, all of whom develop, implement, and evaluate a school curriculum with Industrial Arts complementing and supplementing all other curriculum areas. Into the curriculum of the elementary school are integrated organized programs on occupations which begin as classroom units designed to provide insights into occupations which may be of special interest to the students.

Techniques and Activities to Stimulate Verbal Learning.
Calder, Clarence Jr. and Antan, Eleanor M., The Macmillan Company, New York, 1970.

Constructing, manipulating, viewing, and demonstrating are techniques of learning which the elementary teacher should utilize when educating a class. This publication expresses the need for learning activities, construction techniques, utilization of activities, tools, materials, and supplies, in the elementary school system.

Included are: 1) charts on "levels of abstraction of instructional materials" and "pupils learning record", 2) How to better utilize audio- visual aids, 3) Techniques in drawing, printing, paper mache, and use of bulletin boards and displays, 4) The use of hand tools is a bonus for the elementary teacher who has never had any experience. All explanations are made clear with illustrations, 5) How to find materials and supplies, and when to use them are presented for proper student age to corresponding tool use. Many learning activity examples are in the book with procedures and applications.

Caney, Steven. Toy Book, New York: Workman Publishing Co., 1972.

The purpose of this book is to encourage a parent or teacher to become more involved with their children through toy making. Creativity and inventiveness are stressed, rather than the correct method to perfectly construct each item. Most of the toys are made from everyday objects, which cost little or nothing. Some of the projects are based on folk toys hundreds of years old, while others are popular toys redesigned to be homemade. The toy receipes were created mostly by the author and a group of youngsters who helped design, build and photograph. The toys are divided into six categories: Discovery Toys, Pretending Toys, Games, Building Toys, Action Toys, and Design Toys. Directions are simple, yet completely stated, with both diagrams and large, clear pictures presented. The book was definitely created with kids in mind, kids of all ages.

Geil, J. A New Point of View A Guide to Beginning Tool Activity in Elementary Career Education and Industrial Arts. New Britain, Conn.: Stanley Tools, 1974.

This publication is intended as a guideline for Elementary School instructors for implementing Industrial Arts and Career Education programs at the elementary level. Emphasis is focused on tool uses, how tools are used and how they effect our everyday lives. The abundance of wood and its many everyday uses is briefly discussed to show its importance in our society. The bulk of the publication pertains to starting a program and the various tools needed to successfully run a woodworking program. The publication briefly discusses hand tools and their uses. Tool care and safety are discussed with saws being emphasized as the most dangerous tool in an elementary Industrial Arts shop. A brief list of publications and activities and resources conclude the publication.

Gerbracht, Carl. Elementary School Industrial Arts, New York: Bruce Publishing Co., 1969.

This text is primarily intended for Industrial Arts instructors, however, the text is highly recommended for the elementary teacher. This publication is written up to focus on the role of industrial arts in elementary education and to suggest how the work may proceed. Elementary School Industrial Arts indicates that major changes have taken place. Throughout this text these ideas will be stressed upon, along with many other ideas and concepts. Chapter 1 deals with "The Role of Industrial Arts in Elementary Education"; this chapter tells the story of Industrial Arts and how Industrial Arts is relevant to today's education practices. Chapter 2, describing "Industrial Arts in Nontypical Programs," dealing with disadvantaged children along with all possible handicaps a child could have in the elementary school. Chapter 3, deals effectively with the specialized industrial arts workshop or laboratory, as well as with the classroom work areas. The chapter covers "Facilities, Equipment, Tools, and Supplies." Chapter 4, "Basic Skills" is a more detailed expansion of chapter 3. Chapter 5, "Projects and Activities," dealing with new ideas and concepts on projects; these projects are designed for the classroom. It also deals with the organization of projects and activities.

Kirkwood, James, J., Industrial Arts for the Elementary Grades. Dubuque, Iowa: Wm. C. Brown Book Co., 1968.

The book is intended primarily for college students on the undergraduate and graduate level who are taking a course in industrial arts for the elementary grades. It should also serve to guide interested teachers in the elementary school towards a rational approach in using industrial arts activities.

The author selected relevant materials from the growing wealth of sometimes contradictory material and presented them in a meaningful organization. An attempt was made to select material that represented varying viewpoints within what the author considered a broad, rational philosophy.

Much reading was necessary to select the material presented herein. The author has collected within one volume material that the student interested in industrial arts for the elementary grades would normally be required to find on his or her own.

This book is not designed to replace, in any sense, a textbook of industrial arts. It is intended to serve a supplemental function.

Kirkwood, J. and South, R. How to Do Industrial Arts in the Elementary Grades. Dubuque: Iowa, Kendall/Hunt Publishing Co., 1973.

This book is intended for elementary school teachers and definitely for the I.A. consultant.

This book is broken down into two distinct parts. The first part goes into an explanation of what industrial arts is and its purpose in the elementary school. Some practical aspects from the past and how industrial arts goes hand in hand with career education. The book also puts an emphasis on teaching I.A. to the special education students.

The second part of the book consists of projects: Project Ideas, how to set up or assemble line projects, making a pinhole camera, painting and developing your black and white negatives. Materials and construction for elementary I.A. activities is also discussed and how you as a teacher should observe these activities.

Limo, Joan Finchers. What Can I Do Today? New York: Pantheon Books, 1971.

Geared toward young children, a high level of dexterity is not needed for most projects included in this book. Topics covered are: Sculpturing, Printing, Pasting, Stitching, and Decorating. Each project is presented first in a large colorful photo, then illustrated step by step directions. All supplies and instructions are both written and illustrated and simply stated. Materials are inexpensive, and projects are not complicated. Recommended for parents and teachers of grades K-3.

Lavaivre, Noelle. A Book Full of Ideas. New York: St. Martin's Press, 1973.

The inside cover of this book reads: "This book is dedicated to those gadgets that make our dreams come alive." Indeed, the main purpose of the book seems to be to turn boxes, bottles, pencils, pebbles, etc. into extremely creative crafts projects. Its purpose is to encourage the reader to become more aware of objects around himself and become creative with them. The book provides a helpful section on materials and equipment needed. Also, different paints and varnishes and their properties are discussed, along with different glues and materials they are most successful with. Various helpful suggestions on measurement, cutting special items, etc. are included. The book is full of colorful pictures of items, along with diagrams, and clear, concise instructions. This book would be especially useful during gift-giving time.

Miller, W.R. and Boyd, G. Teaching Elementary Industrial Arts. South Holland, Ill.: Goodheart-Willcox Co., 1970.

Intended for Industrial Arts or Elementary Education majors. This book is divided into four sections.

Part one is a study of the role of Industrial Arts in the elementary school and how an industrial arts program can be incorporated in a traditional elementary education program. Chapter 3, "Implementing a Program of Industrial Arts in the Elementary School," is very strong and explains in a step by step

Fashion what the roles of the various people in an educational system are when a program is implemented.

Part Two, "Methods and Materials of Construction" is the strong part of this text. In this section all of the information needed for a basic understanding of elementary industrial arts is included. The various methodological and material aspects of Industrial Arts are placed in one of ten separate categories, and each of these categories is treated as a separate chapter.

Part Three is devoted to correlating constructional activities with the basic elementary school curriculum.

The final section of the book is devoted to the layout and use of an industrial arts activity area as well as equipment, tool, and supply needs.

Swierkos, M.L. and Morse, C.G. Industrial Arts for the Elementary Classroom. Peoria, Illinois: Carles A. Bennett Co., 1973.

This publication was written basically for the elementary school teacher, however, the industrial arts specialist will also find it useful.

The organization of this book is very clear as it is divided into three major areas: The integration of Industrial Arts into the curriculum, the available kinds of materials and projects along with related information, and methods of using industrial arts activities to motivate and involve children in the learning process.

In using this book, one will discover that the information is given in considerable detail along with all the necessary drawings and pictures necessary to perform the activities or construct the projects described.